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MATERIALS RELATING TO THE RESOURCE CONSERVATION AND RECOVERY ACT OF 1976

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INTRODUCTION

"Discarded materials" is a term that encompasses a variety of materials frequently labeled as "Solid Waste": garbage, refuse, waste treatment plant sludge, as well as residuals from industrial, commercial, mining and agricultural operations, and community activities. Recent figures indicate that total materials discarded annually to be 2.8 billion tons dry weight, 135 million tons being post-consumer discarded materials.

The cost of collecting and disposing of these discarded materials ranges in the astronomical figures of $4 to $6 billion annually.

The primary method of disposing of discarded materials is through landfills. In addition to the fact that the cost of landfilling discarded materials is rapidly increasing, 48 of the larger cities in the United States will run out of available landfill within 5 years, and some cities like Jersey City, Kansas City and Boston, already have exhausted their present landfill capacity.

Confronted with the growing problem of how to dispose of billions of tons per year of discarded materials within a limited amount of space the Subcommittee examined the contents of such discarded materials for alternative uses. The enclosed materials illustrate that the existing discarded material can be utilized, dependent on how it is prepared and separated, to produce steam, oil, gas or to recover valuable and scarce metals and paper. Further, the residues in many processes can be used in cement or asphalt, or at the very least, to produce a sanitary landfill.

The recovery of energy or materials from discarded material is an approach that can help the nation achieve energy independence, conserve natural resources, lower our balance of payments, lessen our dependence on foreign materials, remove the garbage from our city streets in a sanitary manner and protect our surface and underground drinking water from leachate.

The following pages present the facts of the problem and the fascinating potential uses of what is presently discarded material.

It is hoped that this Subcommittee can transform what is presently a problem into a lasting benefit.

FRED B. ROONEY,
Chairman, Subcommittee on Transportation and Commerce.

MATERIALS RELATING TO THE RESOURCE CONSERVATION AND RECOVERY ACT OF 1976

I. Discarded Materials Problem

A. COMPOSITION OF NON-HAZARDOUS DISCARDED MATERIALS STREAM

1. Environmental Protection Agency estimates that the "disposal output" of discarded materials produced each year is 3–4 billion tons.

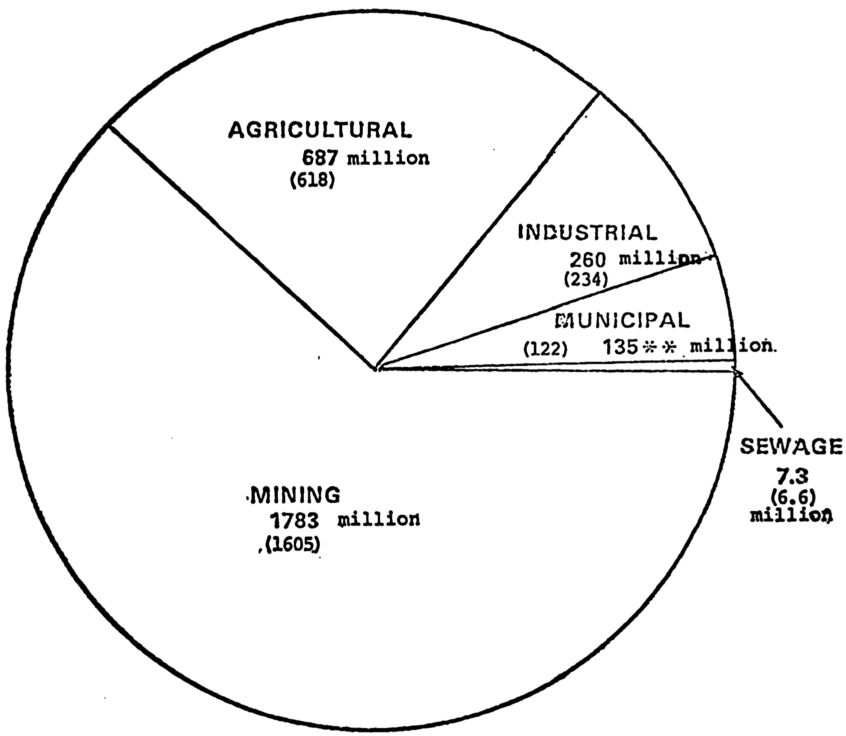
2. According to Environmental Protection Agency statistics submitted upon Subcommittee request, the total discarded material generated from 1970 to 1974 averaged 2.8 billion tons, per year (dry weight). Tables I–1 and I–2, on pages 4 & 5, indicate the following breakdown of the stream:

   a. 1.783 billion is mining.
   b. 687 million is agricultural.
   c. 135 million is municipal.
   d. 260 million is industrial.
   e. 7.3 million is sewage.

Mining processing residuals, though considerably large in size, are not considered in the present discussion of discarded materials, for the "materials discarded" are primarily rock and soil which do not enter the discarded materials stream, require a disposal process much different from that discussed herein for discarded materials, and represent no source of energy recovery.

TABLE I-1

ESTIMATED INDUSTRIAL VERSUS OTHER RESIDUALS *
(DRY WEIGHT IN MILLION TONS PER YEAR)



* DATA REPRESENTS VALUES FROM 1970-1974.

** REPRESENTS VALUE "AS GENERATED" I.E. WITH MOISTURE.

( ) METRIC TONS

Source: EPA statistics submitted upon subcommittee request, 1975.

TABLE I-2.—BREAKDOWN OF TOTAL INDUSTRIAL RESIDUALS[1]

Industry	Quantity of sludge/residual (10^6 tons/yr, dry weight)	
	Short tons	Metric tons
Meat and dairy products	1.6	1.4
Food processing	9.5	8.6
Grain mill products	.2	.2
Textile mill products	1.2	1.1
Paper and allied products	16.8	15.1
Industrial inorganic chemicals	41.0	36.9
Plastics and synthetics	.4	.4
Drugs	10.2	9.2
Soaps and detergents	?	?
Paints and allied products	.4	.4
Industrial organic chemicals	55.0	49.5
Agricultural chemicals	27.5	24.8
Miscellaneous chemical products	.1	.1
Petroleum refining	13.0	11.7
Rubber and miscellaneous plastics	1.5	1.4
Leather and leather products	.4	.4
Glass products	?	?
Cement/clay/pottery products	11.6	10.4
Blast furnaces and steel works	9.2	8.3
Iron and steel foundries	.7	.6
Primary smelting/refining nonferrous metals	7.7	6.9
Fabricated metal products	4.0	3.6
Machinery, except electrical	4.0	3.6
Electrical equipment	2.0	1.8
Transportation equipment	1.8	1.6
Coal fired utilities	43.0	38.7
Total	260.0	237.0

[1] Data values from references dated 1965–74.

Source: EPA statistics submitted upon subcommittee request, 1975.

3. According to the Environmental Protection Agency's Second Report to Congress, which focused strictly on municipal or total post-consumer discarded materials, in 1971 the total post-consumer discarded materials amounted to 125 million tons and in 1973 there was 135 million tons. This shows an increase of 8 percent.

a. Material composition of the 1971 discarded material stream—

i. 80 percent is organic (this includes synthetics).

ii. 20 percent is inorganic: (a) 9.7 percent glass; (b) 9.5 percent metal; and (c) 1.4 percent miscellaneous.

b. Of the materials recoverable as recyclable materials, only the paper, glass and ferrous fractions each comprise more than 8 percent of the total discarded materials stream. Other individual recyclable materials each comprise less than 3 to 4 percent of the total.

c. Product composition of the 1971 discarded materials stream—

i. 80 percent of discarded materials is derived from market product sources as opposed to yard and garden type discarded materials.

(a) excluding discarded food materials, discarded market materials account for 60 percent of the discarded materials stream which is approximately 70–80 million tons.

(b) it is this 70–80 million ton fraction to which waste reduction and material recycling programs are principally directed.

(c) container and packaging materials currently comprise on-third of the total post-consumer discarded materials.

(i) container and packaging is 42 percent of discarded product materials and 54 percent of discarded non-food materials.

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(ii) container and packaging makes up about 72 percent of the total mineral (combined glass and metals) fraction.

(iii) in terms of individual materials the container and packaging industry contributes over: 90 percent of glass in the discarded materials stream; 75 percent of aluminum in the discarded materials stream; 45–50 percent each of ferrous metal, paper and plastic fractions in the discarded materials stream.

ii. Consumer durable goods, including household appliances, furniture, recreational equipment and the like account for about 10–12 percent of the total discarded materials stream.

iii. Newspapers, books, and magazines account for about 8 percent.

iv. See tables I–3, I–4, and I–5 at pages 7, 8, and 9 for a material and product source category breakdown of the 1971 and 1973 discarded materials stream, respectively.

TABLE I-3.—MUNICIPAL SOLID WASTE GENERATION BY MATERIAL AND SOURCE, 1971

Type of material	10^6 tons of waste by product source category							Total			
								As generated		As disposed[1]	
	Newspapers, books, and magazines	Containers and packaging	Major household applicances	Furniture and furnishings	Clothing and footwear	Food products	Other	10^6 tons	Percent	10^6 tons	Percent
Paper	10.3	20.4		Trace	Trace		8.4	39.1	31.3	47.3	37.8
Glass		11.1	Trace	Trace			1.0	12.1	9.7	12.5	10.0
Metal		6.1	1.9	0.1	Trace		3.8	11.9	9.5	12.6	10.1
Ferrous		5.4	1.7	Trace			3.5	10.6	8.5		
Aluminum		.6	.1	Trace			.1	.8	.6		
Other nonferrous		.1	.1	Trace			.2	.4	.3		
Plastic	Trace	2.5	.1	.1	.2		1.3	4.2	3.4	4.7	3.8
Rubber and leather		Trace	.1	Trace	.5		2.7	3.3	2.6	3.4	2.7
Textiles	Trace	Trace		.6	.5		.7	1.8	1.4	2.0	1.6
Wood		1.8		2.3	Trace		.5	4.6	3.7	4.6	3.7
Food						22.0		22.0	17.6	17.7	14.2
Subtotal	10.3	41.9	2.1	3.2	1.2	22.0	18.4	99.1	79.3	104.9	83.9
Yard waste								24.1	19.3	18.2	14.6
Miscellaneous inorganics								1.8	1.4	1.9	1.5
Total								125.0	100.0	125.0	100.0
Percent product source composition	3.2	33.5	1.7	2.6	1.0	17.6	14.7		79.3		83.9

[1] "As disposed" means the "as generated" waste plus the accumulation of moisture.

Note: This chart excludes industrial process wastes, agricultural and animal wastes, abandoned automobiles, ashes, street sweepings, construction and demolition debris and sewage sludges. It also excludes materials separated to be recycled before entering the waste stream.

Source: 1974 EPA "Second Report to Congress".

TABLE I-4.—MATERIAL FLOW ESTIMATES OF RESIDENTIAL AND COMMERCIAL POST-CONSUMER NET SOLID WASTE DISPOSAL, BY KIND OF MATERIAL AND PRODUCT-SOURCE CATEGORY,[1] 1973

Kinds of materials	Product source categories (10^6 tons as-generated weight basis)[2]							Materials totals			
								"As-generated"[2] basis		Converted to "as disposed"[3] basis	
	Newspapers, books, and magazines	Containers and packaging	Major household appliances	Furniture and furnishings	Clothing and footware	Food products	Other products	Million tons	Percent	Million tons	Percent
Paper	11.3	23.3		Trace	Trace		9.6	44.2	32.8	53.4	39.6
Glass		12.1	Trace	Trace			1.1	13.2	9.9	13.4	10.3
Metals		6.5	1.9	0.1	Trace		4.0	12.5	9.3	12.7	9.9
Ferrous		5.6	1.7	Trace			3.7	11.0	8.2		
Aluminum		.8	.1	Trace			.1	1.0	.7		
Other nonferrous		.1	.1	Trace			.2	.4	.3		
Plastics	Trace	3.1 }	.1	.1	0.2		1.6	5.0	3.7	5.6	4.1
Rubber and leather		Trace }		Trace	.5		3.0	3.6	2.7	3.7	2.7
Textiles	Trace	Trace		.6	.6		.7	1.9	1.4	2.1	1.6
Wood		1.9		2.5	Trace		.5	4.9	3.6	4.9	3.6
Nonfood products	11.3	46.9	2.1	3.4	1.3		20.5	85.4	63.5	96.0	71.1
Food wastes						22.4		22.4	16.6	18.0	13.3
Product total	11.3	46.9	2.1	3.4	1.3	22.4	20.5	107.8	80.1	114.0	84.4
Yard wastes								25.0	18.5	19.0	14.1
Miscellaneous inorganics								1.9	1.4	2.0	1.5
Total waste								134.8	100.0	134.8	100.0

Source: Smith, Frank A. and Fred L. Smith. Resource Recovery Division, Office of Solid Waste Management Programs, U.S. Environmental Protection Agency, revised December 1974.

[1] Net solid waste disposal defined as net residual material after accounting for recycled materials diverted from waste stream.

[2] "As-generated" weight basis refers to an assumed normal moisture content of material in its final use; for example: paper at an "air-dry" 7 percent moisture; glass and metals at zero percent.

[3] "As-disposed" basis assumes moisture transfer among materials in collection and storage, but no net addition or loss of moisture for the aggregate of materials. Based on estimates in W. R. Niessen and S. H. Chansky, "The Nature of Refuse," in proceedings, 1970 National Incinerator Conference. New York, Am. Soc. Mech. Engineers, p. 7–8.

Source: EPA update document to "Second Report to Congress".

TABLE I-5.—POST-CONSUMER NET SOLID WASTE DISPOSAL MATERIAL AND PRODUCT-SOURCE COMPOSITION FOR 1971 AND 1973

[As-generated wet weights]

Materials and products	1971, million tons	1973, million tons	Growth, 1971–73: Million tons	Growth, 1971–73: Percent change
Material composition:				
Paper	39.1	44.2	5.1	13.0
Glass	12.0	13.2	1.2	10.0
Metal	11.8	12.5	.7	5.9
Ferrous	(10.6)	(11.0)	(.4)	3.8
Aluminum	(.8)	(1.0)	(.2)	25.0
Other	(.4)	(.4)	(.0)	6.0
Plastics	4.2	5.0	.8	19.0
Rubber and leather	3.3	3.6	.3	9.0
Textiles	1.8	1.9	.1	5.5
Wood	4.6	4.9	.3	6.5
Subtotal, nonfood products	76.9	85.4	8.5	11.1
Food waste	22.0	22.4	.4	1.8
Subtotal, product waste	98.9	107.8	8.9	9.0
Yard waste	24.1	25.0	.9	3.7
Miscellaneous inorganics	1.8	1.9	.1	5.6
Total, material	124.8	134.8	10.0	8.0
Product—Source composition:				
Newspapers, books, magazines	10.3	11.3	1.0	9.7
Containers and packaging	41.7	46.9	5.2	12.5
Major household appliances	2.1	2.1	0	0
Furniture and furnishings	3.2	3.4	.2	6.3
Clothing and footwear	1.2	1.3	.1	8.3
Other products	18.4	20.5	2.1	11.4
Subtotal, nonfood products	76.9	85.4	8.5	11.1
Food waste	22.0	22.4	.4	1.8
Total, product waste	98.9	107.8	8.9	9.0
Add: Yard and miscellaneous inorganics	25.9	26.9	1.0	3.9
Total, waste	124.8	134.8	10.0	8.0

Source: Smith, Frank A. and Fred L. Smith. Resource Recovery Division, Office of Solid Waste Management Programs U.S. Environmental Protection Agency, revised December, 1974.

Net solid waste disposal defined as net residual material after accounting for recycled materials diverted from waste stream.

Source: EPA update document to "Second Report to Congress."

d. Combustion and heat characteristics of the discarded materials stream—

i. 80 percent of the weight of typical raw municipal refuse is composed of combustible materials.

ii. ash content of raw refuse is approximately 20 percent by weight, with non-combustible metal and glass fractions, approximately 5 percent excluding metal and glass. Total weight reduction by burning is therefore approximately 80 percent. The heat values are approximately 4600 BTU's (British thermal units) per pound for total raw refuse and 5500 BTU's per pound for refuse excluding metal and glass.

4. Projected figures for total discarded materials quantities are set out in tables I–6 and I–7, at page 10.

TABLE I-6.—PROJECTED TOTAL SOLID WASTE QUANTITIES*

Assumed annual compound growth (percent)	Waste (10^6 tons)		
	1980	1985	1990
2.5 (low)	155	175	200
3.5 (medium)	170	200	230
4.5 (high)	185	230	290

*1971 base equals 125,000,000 tons.
Note: Projections are based on a detailed product-by-product analysis of all major waste components. These figures assume no new intervention by the Federal Government concerning resource recovery systems.
Source: EPA update document to "Second Report to Congress," 1975.

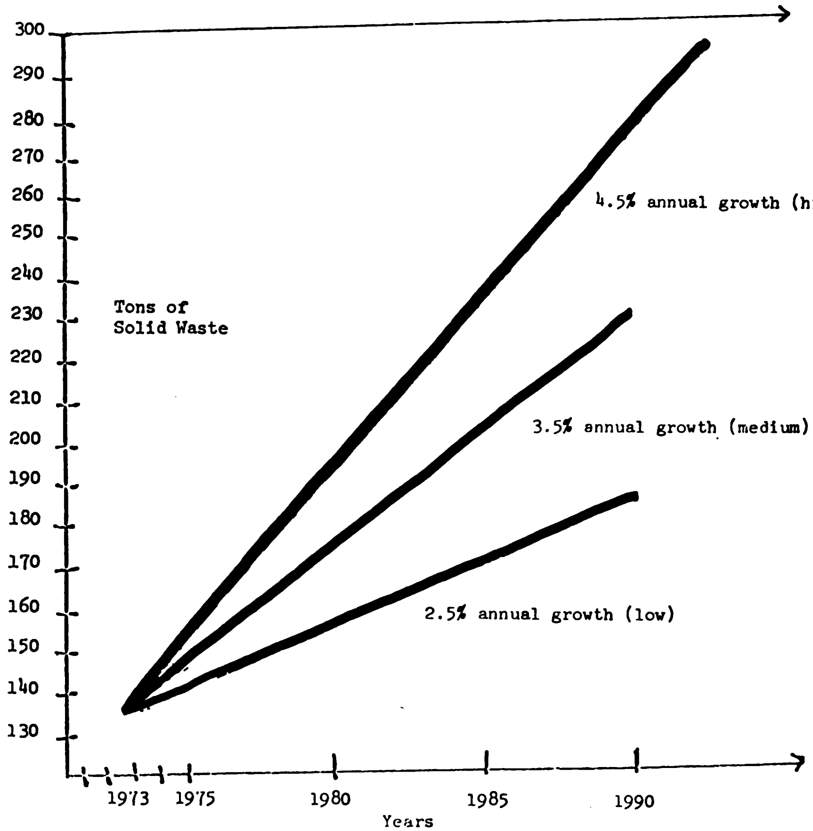

TABLE I-7.—BASELINE ESTIMATES AND PROJECTIONS OF POSTCONSUMER SOLID WASTE GENERATION, RESOURCE RECOVERY AND DISPOSAL, 1971 TO 1990[1]

	Estimated		Projected		
	1971	1973	1980	1985	1990
Total gross discards:					
Million tons per year	133	144	175	201	225
Pounds per person per day	3.52	3.75	4.28	4.67	5.00
Less: Resources recovered:					
Million tons per year	8	9	19	35	58
Pounds per person per day	0.21	0.23	0.46	0.81	1.29
Equals net waste disposed of:					
Million tons per year	125	135	156	166	167
Pounds per person per day	3.31	3.52	3.81	3.86	3.71

[1] Office of Solid Waste Management Programs, Resource Recovery Division. Data revised December 1974. Projections for 1980 to 1990 based in part on contract work by Midwest Research Institute.

Source: EPA update document to "Second Report to Congress, 1975."

B. COLLECTION OF DISCARDED MATERIALS

1. Municipal discarded materials (residential and commercial wastes)

a. a 1974 survey by the International City Management Association of cities over 10,000 population indicated that 61 percent of the cities operated a residential collection system and 39 percent operated a commercial collection system.

b. in cities which do not operate a collection system or in cities where the municipal system does not collect all of the discarded materials, private haulers perform this service, either under contract to the city or working directly for the homeowner or business establishment.

c. a 1970 survey showed that private haulers collect 50 percent of the total residential discarded materials and 90 percent of the commercial discarded materials.

d. collection techniques:

i. commercial collection is generally conducted with a driver and a truck which is capable of mechanically lifting and emptying the large bulk containers used by commercial establishments.

ii. residential collection usually involves manually emptying discarded materials into the collection vehicle. The number of crew members on a truck can range from one to five.

e. frequency of collection:

i. for relatively efficient systems, 23 to 33 percent fewer vehicles are required for once-a-week, compared with twice-a-week, collection.

ii. fuel consumption is about 30 percent less, and the reduction in trucks, manpower, and miles driven can cut costs by as much as 50 percent.

iii. in 1974 approximately half the cities of over 10,000 population collected twice a week.

2. Industrial discarded materials

a. almost exclusive collection by private discarded materials contractors, although in some cases a manufacturer may collect and haul his own discarded materials to the disposal site.

b. because of the large volumes of discarded materials involved at industrial facilities, collection techniques are almost fully automated.

C. DISPOSAL OF DISCARDED MATERIALS

1. Landfills

a. Sanitary landfilling is an engineered method of disposing of discarded materials on land in a manner that minimizes environmental hazards and nuisances. At a site that is carefully selected, designed, and prepared, the wastes are spread in thin layers, compacted to the smallest practical volume, and, at least at the end of each operating day, covered with compacted earth.

b. In a survey by *Waste Age*, January, 1975, it was estimated that of the approximately 18,500 known land disposal sites, only about 5,600 were recognized as being in compliance with state regulations.

c. A 1972 survey of 70 United States cities, conducted by the National League of Cities indicates the following:

i. average landfill capacity is 156 acres (range is 0–32,107 acres).

ii. a number of cities have no landfill capacity: Jersey City, New Jersey; Kansas City, Missouri; Garden Grove, Connecticut; Boston, Massachusetts; and Trenton, New Jersey.

iii. average acquisition cost per acre of landfill is $13,260 (range is $500–200,000 per acre). This figure represents an average increase of 55 percent in such costs over the past five years (range 0 to 300 percent).

iv. increasing scarcity of available landfill sites will mean an increase in the cost of land, was well as an increase in cost to transport discarded materials to more distant sites.

d. Although sanitary landfills have usually been considered environmentally acceptable, very few have been designed to control leachate. According to "Leachate effects of improper land disposal", *Waste Age*, 6(3), March, 1975, there is increasing evidence that potential underground leachate problems are more serious than previously thought, with adverse implications for the quality of both ground and surface waters.

2. Open dumps

a. The greater part of municipal discarded materials is probably still disposed of in this manner.

b. As recently as the summer of 1972, it was determined that more than 14,000 disposal sites classified as dumps still operated in the United States.

3. Waste incineration

a. As of mid-1972, nearly 200 municipal-scale incinerators operated in the United States, processing discarded materials at a rate of about 17 million tons per year (Environmental Protection Agency 1973 assessment of municipal-scale incinerators).

b. Incinerators produce a variety of atmospheric emissions, and many are also a significant source of untreated waste-water effluent.

c. Most are in the northeast quarter of the nation, with over one-half being in the densely populated eastern seaboard states. Thus, their principal contributions to pollution are in areas where the damages are likely to be the greatest.

d. The fact that cities must meet requirements for pollution control as set by state and regional environment protection agencies in conjunction with Federal guidelines will have a direct impact on incinerator and sanitary landfill costs.

D. COLLECTION/DISPOSAL COST

1. Present cost

The cost for collecting and disposing of discarded materials ranks as the second largest expenditure of our nation's larger cities. This expenditure is funded solely by local revenues.

a. According to the Environmental Protection Agency's "Third Report to Congress, Resource Recovery and Waste Reduction," $3.5 billion was spent to collect and dispose of the nation's 135 million tons of post-consumer discarded materials in 1973.

b. Commercial collection cost is approximately 50 percent less than residential collection cost and is 40 percent of the total post-consumer discarded materials.

c. It currently costs $21 to collect a ton of discarded materials and $5 per ton to process and landfill it. These are national average

figures for 1974, reflecting current practices in which a majority of communities do not provide environmentally adequate disposal facilities.

d. Collection costs vary between $10–30 depending on local circumstances and level of services; actual disposal costs range from under $1 per ton to uncontrolled land dumping up to as high as $15–20 per ton for incineration (with air pollution controls) and landfilling the residue.

e. It is to be noted these figures are representative of direct costs only and do not include any imputed economic value for the "external" environmentally related social costs of discarded materials disposal.

f. Table I–8 is a summary of the treatment and disposal costs for the industrial inorganic chemicals industry. The proper management of residuals in this category can cost 50 to 100 times more than simple dumping or ponding of discarded materials.

TABLE I–8.—TREATMENT/DISPOSAL COST, INORGANIC CHEMICALS INDUSTRY

Disposal method:	*Cost ($1 ton) (1974 est.)*
Dumping	0–1.
Landfill	0–6.
Deep well injection	6–9.
Reclamation	2–6.
Drum disposal in landfill	15–25.
Ocean disposal (varies with quantity)	4–16.
Pond disposal (contractor)	1–1.50.
Secure landfill:	
Bulk	27–40.
Drums	50–100.
Chemical fixation	4–10.[1]

[1] Not including cost of removing fixed waste if it cannot be landfilled on site.

2. Future cost

Future collection and disposal costs are difficult to accurately predict. The Environmental Protection Agency states a reasonable expectation is that the average community will face a 20 to 30-percent increase in its direct real costs of discarded materials disposal by 1985, even without adding on the effects of general inflation. This implies a national average cost by 1985 of $8 to $12 per ton for disposal (including transfer stations and processing) and perhaps $30 to $35 per ton for collection and disposal combined. Adding on an average 4 percent per year inflation rate, for example, would imply a 1985 collection and disposal cost for the average city of $50 per ton.

E. HAZARDOUS DISCARDED MATERIALS

1. Nature of hazardous discarded materials

a. Definition.—According to the Environmental Protection Agency's "Report to Congress, Disposal of Hazardous Wastes, 1974," the term "hazardous waste" means any waste or combination of wastes which pose a substantial present or potential hazard to human health or living organism because such discarded materials are lethal; nondegradable, or persistant in nature; may be biologically magnified; or may otherwise cause or tend to cause detrimental cumulative effects. According to Environmental Protection Agency information submitted upon Subcommittee request, the Environmental Protection Agency stated that they are still studying the variety of definitional options that are available to amplify its basic definition.

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b. General categories of hazardous discarded materials: i. Toxic chemical; ii. flammable; iii. radioactive; iv. explosive; v. biological.

c. Hazardous discarded materials may be in the form of solids, sludges, liquids, and gases.

2. Sources of hazardous discarded materials

a. Industry.

b. Federal Government—Atomic Energy Commission, Department of Defense.

c. Agriculture.

d. Institutions such as hospitals and laboratories.

3. Quantities of hazardous discarded materials

a. Discarded materials streams containing hazardous compounds are identified and quantified by industrial source in tables I–9, page 15 and I–10, at page 17.

i. The decision model used for these tables for selecting the discarded materials streams was rather unsophisticated and the hazardous compounds and discarded materials streams cited should be considered illustrative rather than those that should be regulated.

ii. It should be noted that the discarded materials legislation under consideration by the subcommittee excludes radioactive and pesticide materials from its regulation.

Table I-9

HAZARDOUS WASTE STREAM DATA

Identifying and quantifying the Nation's hazardous waste streams proved to be especially formidable because historically there has been little interest in quantifying specific amounts of waste materials, with the exception of radioactive wastes.

Distribution and volume data by Bureau of Census regions were compiled on those nonradioactive waste streams designated as hazardous . The approach used is predicated on the assumption that the hazardous properties of a waste stream will be those of the most hazardous pure compound within that waste stream. Wastes containing compounds with values more than or equal to threshold levels established for the various hazardous properties are classified as hazardous. This approach takes advantage of the available hazard data on pure chemicals and avoids speculation on potential compound interactions within a waste stream. A list follows to illustrate types of chemical compounds in the Nation's waste streams that could be regarded as hazards to public health and the environment:

Miscellaneous inorganics

Ammonium chromate
Ammonium dichromate
Antimony pentafluoride
Antimony trifluoride
Arsenic trichloride
Arsenic trioxide
Cadmium (alloys)
Cadmium chloride
Cadmium cyanide
Cadmium nitrate
Cadmium oxide
Cadmium phosphate
Cadmium potassium cyanide
Cadmium (powdered)
Cadmium sulfate
Calcium arsenate
Calcium arsenite
Calcium cyanides
Chromic acid
Copper arsenate
Copper cyanides
Cyanide (ion)
Decaborane
Diborane
Hexaborane
Hydrazine
Hydrazine azide
Lead arsenate
Lead arsenite
Lead azide
Lead cyanide
Magnesium arsenite
Manganese arsenate
Mercuric chloride
Mercuric cyanide
Mercuric diammonium chloride
Mercuric nitrate
Mercuric sulfate
Mercury
Nickel carbonyl
Nickel cyanide
Pentaborane-9
Pentaborane-11
Perchloric acid (to 72 percent)
Phosgene (carbonyl chloride)
Potassium arsenite
Potassium chromate
Potassium cyanide
Potassium dichromate
Selenium
Silver azide
Silver cyanide

Source: 1974 EPA Report to Congress: Disposal of Hazardous Wastes

Table I-9, cont'd

Sodium arsenate
Sodium arsenite
Sodium bichromate
Sodium chromate
Sodium cyanide
Sodium monofluoroacetate
Tetraborane
Thallium compounds
Zinc arsenate
Zinc arsenite
Zinc cyanide

Halogens and interhalogens

Bromine pentafluoride
Chlorine
Chlorine pentafluoride
Chlorine trifluoride
Fluorine
Perchloryl fluoride

Miscellaneous organics

Acrolein
Alkyl leads
Carcinogens
Copper acetoarsenite
Copper acetylide
Cyanuric triazide
Diazodinitrophenol (DDNP)
Dieldrin
Dimethyl sulfate
Dinitrobenzene
Dinitro cresols
Dinitrophenol
Dinitrotoluene
Dipentaerythritol hexanitrate (DPEHN)
Gelatinized nitrocellulose (PNC)
Glycol dinitrate
Gold fulminate
Lead 2,4-dinitroresorcinate (LDNR)
Lead styphnate
Mannitol hexanitrate
Mercury compounds (organic)
Methyl parathion
Nitroaniline
Nitrocellulose
Nitroglycerin
Parathion
Picric acid
Potassium dinitrobenzfuroxan (KDNBF)
Silver acetylide
Silver tetrazene
Tetrazene
VX [ethoxymethylphosphoryl-*N,N*-dipropoxy-(2,2)-thiocholine]

Organic halogen compounds

Aldrin
Chlordane
Chlorinated aromatics
Chloropicrin
Copper chlorotetrazole
DDD
DDT
2,4-D (2,4-dichlorophenoxyacetic acid)
Demeton
Endrin
Ethylene bromide
Fluorides (organic)
GB [propoxy-(2)-methylphosphoryl fluoride]
Guthion
Heptachlor
Lewisite (2-chloroethenyl dichloroarsine)
Lindane
Methyl bromide
Methyl chloride
Nitrogen mustards (2,2',2"-trichlorotriethylamine)
Pentachlorophenol
Polychlorinated biphenyls (PCB)
Tear gas (CN) (chloroacetophenone)
Tear gas (CS) (2-chlorobenzylidene malononitrile)

It should be noted that this list is not an authoritative enumeration of hazardous compounds but a sample list which will be modified on the basis of further studies. Compounds on the list should not be construed as those to be regulated under the proposed Hazardous Waste Management Act. Table I-10 identifies those radioactive isotopes that are considered hazardous from a disposal standpoint. Detailed data sheets describing the volumes, constituents, concentrations, hazards, disposal techniques, and data sources for each waste stream are available in EPA Contract No. 68-01-0762.

Table I-10

SUMMARY DATA FOR NONRADIOACTIVE WASTE STREAMS*

Waste stream title	Standard industrial code	Percentage by geographic area†									Volume (lb/yr)	Remarks
		NE	MA	ENC	WNC	SA	ESC	WSC	M	W		
Aqueous inorganic:												
Chromate wastes from textile dyeing	22	0.101	0.178	0.034	0.005	0.568	0.034	0.014	0.006	0.060	2×10^7, maximum	
Chlorine production brine sludges	2812	.02	.11	.10	–	.19	.22	.24	–	.12	1×10^8	
Potassium chromate production wastes	2819	.19	.06	.015	.005	.60	.10	.01	.01	.01	1×10^6	
Cellulose ester production wastes	2821	.10	.21	.21	.16	.14	.07	.10	--	.02	5×10^7	
Intermediate agricultural product wastes (nitric acid)	287	.005	.075	.145	.074	.299	.207	.090	.046	.058	2×10^6	
Production works from ammonium sulfate	2873	–	–	.040	–	--	–	–	.96	–	1×10^3	
Copper- and lead-bearing petroleum refinery wastes	291	.001	.102	.175	.056	.019	.031	.417	.039	.160	8×10^8	
Chrome tanning liquor	31	.22	.29	.29	.03	.086	.05	.004	–	.03	2×10^7	
Mirror production wastes	3231	.09	.25	.23	.01	.28	.10	.04	–	–	9×10^6	
Cold finishing wastes	331	.03	.34	.43	.01	.07	.02	.05	.04	.01	5×10^9	
Consolidated steel plant wastes	331	.02	.33	.42	.02	.09	.02	.03	.05	.02	5×10^8	
Stainless steel pickling liquor	3312	.050	.259	.404	.026	.068	.055	.044	.028	.067	5×10^7	
Brass mill wastes	333	.04	.29	.01	.25	.01	.04	.04	.13	.19	5×10^7	
Metal finishing wastes:	33	.115	.179	.379	.046	.050	.015	.036	.011	.169	4×10^7	Cyanide solution
Aluminum anodizing bath with drag out		.115	.179	.379	.046	.050	.015	.036	.011	.169	8×10^6	Metal sludges
Brass plating wastes		.115	.179	.379	.046	.050	.015	.036	.011	.169	Not available	
Cadmium plating wastes		.131	.285	.321	.045	.049	.023	.036	.007	.103	1×10^6	
Chrome plating wastes		.115	.179	.379	.046	.050	.015	.036	.011	.169	Not available	
Cyanide copper plating wastes		.115	.179	.379	.046	.050	.015	.036	.011	.169	2×10^6	
Finishing effluents		.115	.179	.379	.046	.050	.015	.036	.011	.169	Not available	
Metal cleaning wastes		.115	.179	.379	.046	.050	.015	.036	.011	.169	Not available	
Plating preparation wastes		.115	.179	.379	.046	.050	.015	.036	.011	.169	Not available	
Silver plating wastes		.115	.179	.379	.046	.050	.015	.036	.011	.169	Not available	
Zinc plating wastes		.115	.179	.379	.046	.050	.015	.036	.011	.169	Not available	
Metal finishing chromic acid	34	.244	.198	.149	.095	.081	.032	.031	.041	.031	4.4×10^7	
Graphic arts and photography wastes	3555	.06	.19	.20	.08	.15	.06	.09	.13	.04	4×10^3	
Electronic circuitry manufacturing wastes	36	.143	.342	.170	.037	.053	.019	.032	.039	.165	5×10^5	
Aircraft plating wastes	372	.123	.158	.117	.093	.057	.013	.095	.019	.325	4×10^7	
Cooling tower blowdown	–	.005	.150	.170	.060	–	.58	--	.035	–	2×10^7	As chromate
Subtotal											7×10^9	
Organic:												
Cosynthesis methanol production wastes	2818	–	–	.05	–	.05	–	.90	–	–	1×10^6	Sludge
Formaldehyde production wastes	2818	–	–	.02	–	.05	–	.93	–	-	8×10^5	Sludge
n-Butane dehydrogenation butadiene production wastes	2818	–	–	.03	--	–	–	.02	--	.05	3×10^5	Sludge
Rubber manufacturing wastes	2822	–	.07	.14	–	.11	.11	.50	–	.07	1×10^6	
Benzoic herbicide wastes (DOD)	2879	.168	.130	.009	–	.447	–	-	–	.246	3×10^3	
Chlorinated aliphatic herbicide wastes (DOD)	2879	.196	.062	.027	–	.649	–	.010	.057	--	5×10^3	
Phenyl urea herbicide wastes (DOD)	2879	.539	.059	–	–	.343	.059	–	–	--	2×10^3	
Halogenated aliphatic hydrocarbon fumigant wastes (DOD)	2879	1.0	–	–	–	–	–	–	–	–	2×10^3	
Organophosphate pesticide wastes (DOD)	2879	.0007	.014	.010	–	.033	--	–	.014	.929	1×10^5	
Phenoxy herbicide	2879	.0002	.0001	.0007	–	.0008	.849	.149	.0002	.0004	8 [illegible]	

NOTE– Footnotes appear on the last page of the table.

Source: 1974 EPA Report to Congress: Disposal of Hazardous Wastes

cont'd

Table I-10, cont'd

SUMMARY DATA FOR NONRADIOACTIVE WASTE STREAMS—*Continued*

Waste stream title	Standard industrial code	Percentage by geographic area: NE	MA	ENC	WNC	SA	ESC	WSC	M	W	Volume (lb/yr)	Remarks
Carbonate pesticide manufacturing (DOD)	2879	–	–	–	.006	.848	–	–	–	.145	3×10^5	
Polychlorinated hydrocarbon pesticide wastes (DOD)	2879	.097	.142	.018	.003	.096	.004	.033	.017	.591	1×10^5	
Miscellaneous organic pesticide manufacturing waste (DOD)	2879	–	.026	.012	.002	.257	–	–	–	.702	3×10^6	
Contaminated and waste industrial propellants and explosives	2892	–	–	–	–	–	–	–	.344	.655	3×10^5	
Contaminants and waste from primary explosives production	2892	–	.096	.001	.898	–	.001	–	.003	.001	4×10^6	
Nitrocellulose base propellant contaminated waste	2892	–	.041	–	.457	.492	–	–	.009	–	9×10^6	
High explosive contaminated wastes	2892	–	.005	.094	.394	.397	.027	.004	.023	.012	1×10^7	
Incendiary contaminated wastes	2892	–	–	–	–	–	–	1.0	–	–	6×10^5	
Production of nitroglycerin	2892	–	–	–	–	.42	.19	–	–	.39	7×10^5	
Solid waste from old primers and detonators	2892	–	.005	.430	.454	.001	.006	–	.084	.014	3×10^5	
Wastes from production of nitrocellulose propellants and smokeless powder	2892	–	.060	.046	.387	.477	–	.006	.025	–	6×10^6	
Waste high explosives	2892	.002	.006	.346	.174	.218	.104	.127	.010	.001	1×10^7	
Waste incendiaries	2892	–	.014	.002	.002	–	–	.718	.009	.255	8×10^5	
Waste nitrocellulose and smokeless powder	2892	–	–	–	–	–	–	–	.406	.594	2×10^6	
Waste nitroglycerin	2892	–	–	.01	–	.50	.22	–	.004	.266	5×10^5	
Nonutility polychlorinated biphenyl wastes	2899	.037	.221	.372	.153	.040	.041	.057	.009	.072	8×10^6	
Gasoline blending wastes	2911	.006	.086	.159	.055	.025	.025	.477	.033	.134	4×10^8	
Reclaimers residues	2992	.040	.120	.205	.081	.135	.082	.139	.044	.155	3×10^8	
Coke plant raw waste	3312	.02	.33	.41	.01	.07	.02	.06	.06	.02	8×10^7	
Military arsenical wastes	9711	–	.002	.001	–	.015	.031	.001	.024	.926	3×10^6	
Outdated or contaminated tear gas	9711	–	.138	.189	–	.022	.044	.252	.144	.209	3×10^8	
Subtotal											1×10^9	
Aqueous organic:												
Dimethyl sulfate production wastes	2611	–	(‡)	–	–	(‡)	–	–	–	–	2×10^5	Still bottoms
Acetaldehyde via ethylene oxidation	281	.015	.170	.156	.047	.156	.111	.265	.020	.060	8×10^7	
Residue from manufacture of ethylene dichloride/vinyl chloride	2821	–	.021	.015	–	.163	.171	.533	–	.117	2×10^7	
Nitrobenzene from rubber industry wastes	2822	–	.07	.14	–	.11	.11	.50	–	.07	5×10^9	Probably too dilute to be of concern
Drug manufacturing wastes	283	.056	.348	.183	.089	.100	.033	.060	.011	.115	5×10^9	Probably too dilute to be of concern
Chlorinated hydrocarbon pesticide production wastes	2879	.115	.148	.136	.073	.141	.057	.093	.054	.183	2×10^8	
Miscellaneous organic herbicide production wastes	2879	.076	.135	.124	.080	.156	.062	.108	.059	.200	4×10^8	
Organo-phosphate pesticide production wastes	2879	.115	.148	.136	.073	.141	.057	.093	.054	.183	6×10^7	
Organic pesticide production wastes	2879	.115	.148	.136	.073	.141	.057	.093	.054	.183	3×10^8	
Phenoxy herbicide production wastes	2879	.076	.135	.124	.080	.156	.062	.108	.059	.200	4×10^7	
Subtotal											1×10^{10}	

Table I-10, cont'd

Solid, slurry, or sludge:												
Recovered arsenic from refinery flues (stored)	1021	–	–	–	–	–	–	–	–	1.00	4×10^7	Tacoma, Wash.
Sodium dichromate production wastes	2819	–	.150	.243	–	.437	–	.170	–	–	3×10^8	
Solvent-based paint sludge	285	.044	.243	.269	.072	.103	.041	.069	.012	.147	4×10^7	
Water-based paint sludge	285	.044	.243	.269	.072	.103	.041	.069	.012	.147	3×10^7	
Tetraethyl and tetramethyl lead production wastes	2869	–	–	–	–	–	–	.63	–	.37	3×10^5	
Urea production wastes	2873	–	.05	.09	.18	.09	.15	.29	–	.14	2×10^5	Dry basis
Benzoic herbicide contaminated containers	2879	–	–	.655	.154	.006	.017	–	.009	.160	2×10^4	
Calcium arsenate contaminated containers	2879	.03	.02	.08	.07	.16	.16	.35	.09	.03	6×10^3	
Carbonate pesticide contaminated containers	2879	.0008	.016	.382	.070	.022	.108	.321	.020	.060	5×10^4	
Chlorinated aliphatic pesticide contaminated containers	2879	.381	–	.076	.418	–	.105	.010	–	.010	1×10^4	
Dinitro pesticide contaminated containers	2879	.496	.168	.023	.017	.228	–	.003	.006	.165	2×10^4	
Lead arsenate contaminated containers	2879	.03	.02	.08	.07	.17	.17	.35	.03	.08	1×10^4	
Mercury fungicide contaminated containers	2879	.02	.03	.04	.03	.28	.32	.05	.01	.22	5×10^3	
Miscellaneous organic insecticide contaminated containers	2879	.148	.084	.054	.039	.197	.143	.148	.017	.170	4×10^4	
Organic arsenic contaminated containers	2879	–	.007	–	–	.011	.764	.218	–	–	5×10^3	
Organic fungicide contaminated containers	2879	.048	.125	.047	.028	.441	.001	.036	.007	.266	8×10^4	
Organophosphorus contaminated containers	2879	.043	.050	.018	.125	.139	.192	.175	.049	.208	1×10^5	
Phenoxy contaminated containers	2879	.035	.033	.196	.321	.031	.030	.067	.141	.146	2×10^5	
Phenyl urea contaminated containers	2879	.106	.085	.106	.033	.106	.424	.042	.003	.095	9×10^3	
Polychlorinated hydrocarbon contaminated containers	2879	.017	.107	.019	.138	.306	.211	.133	.024	.044	2×10^5	
Triazine contaminated containers	2879	.147	.121	.320	.372	.013	.003	.011	.002	.011	6×10^4	
Miscellaneous organic pesticide contaminated containers	2879	.014	.162	.385	.068	.162	.123	.041	.014	.034	1×10^4	
Petroleum refining still bottoms	2911	.006	.086	.159	.055	.025	.025	.477	.033	.134	2×10^6	
Petroleum waste brine sludges	2911	.002	.06	.09	.011	.12	.10	.55	.022	.045	4×10^6	
Iron manufacturing waste sludge	331	.05	.05	.56	.02	.12	.03	.09	.05	.03	6×10^6	
Arsenic trioxide from smelting industry	333	–	.03	.015	.07	.005	.01	.10	.70	.07	2×10^7	
Selenium production wastes	3339	–	.75	–	–	–	–	–	.25	–	2×10^4	
Duplicating equipment manufacturing wastes	3555	–	1.00	–	–	–	–	–	–	–	7×10^5	Upstate New York
Refrigeration equipment manufacturing wastes	3585	.013	.232	.408	.096	.040	.069	.086	.011	.045	2×10^8	
Battery manufacturing waste sludge	3691	.117	.043	–	.118	.117	–	–	.118	–	5×10^7	
Arsenic trichloride recovered from coal	49	.05	.23	.07	.05	.33	.25	–	.07	–	6×10^6	
Military paris green (stored)	9711	–	–	1.00	–	–	–	–	–	–	3×10^4	
Stored military mercury compounds	9711	.47	–	–	.51	–	–	–	–	.02	2×10^2	
Subtotal											7×10^8	
Aqueous inorganic (insufficient quantity or distribution data):												
Zinc ore roasting acid wash	1031					Not available					Not available	
Mercury extraction wastes	1092	–	–	–	–	–	–	–	.28	.72	Not available	
Cadmium ore extraction wastes	1099					Not available					2×10^8	
Mercury bearing textile wastes	22					Not available					Not available	
Wastes from pulp and paper industry	26	.11	.11	.19	.04	.23	.08	.10	.03	.11	Negligible	
Cadmium-selenium pigment wastes	28					Not available					Not available	
Waste or contaminated perchloric acid	28					Not available					Negligible	
Arsine production wastes	2813	(‡)	(‡)	(‡)	–	–	(‡)	(‡)	–	(‡)	1×10^4	
Borane production wastes	2813	–	1.0	–	–	–	–	–	–	–	Negligible	
Nickel carbonyl production wastes	2813	–	1.0	–	–	–	–	–	–	–	Negligible	
Waste bromine pentafluoride	2813	–	–	–	–	–	–	1.0	–	–	Negligible	
Waste chlorine pentafluoride	2813	–	–	(‡)	–	–	–	(‡)	–	–	Negligible	
Waste chlorine trifluoride	2813	–	–	(‡)	–	–	–	(‡)	–	–	Negligible	

Table I-10, cont'd

SUMMARY DATA FOR NONRADIOACTIVE WASTE STREAMS—[redacted]

Waste stream title	Standard industrial code	Percentage by geographic area[*] NE	MA	ENC	WNC	SA	ESC	WSC	M	W	Volume (lb/yr)	Remarks
Chromate wastes from pigments and dyes	2816	.015	.170	.156	.047	.156	.111	.265	.020	.060	1×10^{11}(§)	
Arsenic wastes from purification of phosphoric acid	2819	.015	.170	.156	.047	.156	.111	.265	.020	.060	Negligible	
Contaminated fluorine	2819	.007	.101	.166	.075	.147	.207	.147	.054	.096	Negligible	
Cyanide production wastes	2819	.007	.101	.166	.075	.147	.207	.147	.054	.096	2×10^{11}(§)	
Waste from manufacture of mercuric cyanide	2819	–	1.0	–	–	–	–	–	–	–	Negligible	
Waste from production of barium salts	2819	.007	.101	.166	.075	.147	.207	.147	.054	.096	Negligible	
Urethane manufacturing wastes	2821	.046	.121	.101	.018	.404	.182	.101	–	.027	2×10^{12}(§)	
Wastes from polycarbonate polymer production	2821	.046	.121	.101	.018	.404	.182	.101	–	.027	2×10^{12}(§)	
Pharmaceutical arsenic wastes	283	.056	.348	.183	.089	.100	.033	.060	.011	.115	Negligible	
Pharmaceutical mercurial wastes	283	.056	.348	.183	.089	.100	.033	.060	.011	.115	Negligible	
Wood preservative wastes	2865	.007	.029	.117	.060	.267	.141	.174	.042	.162	2×10^{11}(§)	
Contaminated antimony pentafluoride	2869	–	(‡)	(‡)	–	–	–	(‡)	–	–	Negligible	
Contaminated antimony trifluoride	2869	–	(‡)	(‡)	–	–	–	(‡)	–	–	Negligible	
Hydrazine production wastes	2869	(‡)	(‡)	–	–	(‡)	–	(‡)	–	–	Not available	
Agricultural chemical production wastes	287	.005	.075	.145	.074	.299	.207	.090	.046	.058	2×10^{12}(§)	
Agricultural pesticide arsenic wastes	2879	.005	.075	.145	.074	.299	.207	.090	.046	.058	2×10^{12}(§)	
Mercuric fungicide production wastes	2879	.005	.075	.145	.074	.299	.207	.090	.046	.058	2×10^{12}(§)	
Pesticide arsenate wastes	2879	.005	.075	.145	.074	.299	.207	.090	.046	.058	2×10^{12}(§)	
Pesticide arsenic wastes	2879	.005	.075	.145	.074	.299	.207	.090	.046	.058	2×10^{12}(§)	
1080 production wastes and contaminated lots	2879	–	(‡)	–	–	(‡)	1.0	–	–	–	Negligible	Production of sodium fluoracetate
Wastes from pesticide-herbicide manufacture (arsenites)	2879	.005	.075	.145	.074	.299	.207	.090	.046	.058	2×10^{12}(§)	
Electrical fuse manufacturing wastes	2899	.037	.221	.372	.153	.039	.040	.057	.009	.072	2×10^{12}(§)	
Beryllium salt production wastes	3339	–	1.0	–	–	–	–	–	–	–	Negligible	
Thallium production wastes	3339	–	–	–	–	–	–	1.0	(‡)	–	Negligible	Small amount in Colorado
Rotogravure printing plate wastes	3555	.105	.446	.320	.051	.019	–	.028	–	.031	1×10^{12}(§)	
Computer manufacturing wastes	3573	.143	.342	.170	.037	.053	.019	.032	.039	.165	1×10^{12}(§)	
Electronic tube production wastes	367	.143	.342	.170	.037	.053	.019	.032	.039	.165	Not available	
Magnetic tape production wastes	3679	.171	.336	.165	.120	.077	.016	.060	–	.060	Not available	
Battery manufacturing wastes	3691	.030	.236	.289	.111	.103	.029	.056	.012	.134	1.1×10^{12}	
Mercury cell battery wastes	3692	.060	.138	.556	.049	.074	.019	.017	(¶)	(¶)	1.1×10^{12}(§)	
Railroad engine cleaning	40					Not available					Not available	
Arsenic wastes from transportation industry	40					Not available					Not available	
Military cadmium wastes from plating	9711					Not available					Not available	
Military sodium chromate	9711					Not available					Not available	
Subtotal											2×10^{8}	
Organic (insufficient quantity or distribution data):												
Spent wood-preserving liquors	2491	.007	.029	.117	.060	.267	.141	. 74	.042	.162	2×10^{12}(§)	
Off-specification "agent orange" defoliant	9711					Not available					Not available	

Table I-10, concluded

Paint stripping wastes, Vance Air Force Base, Oklahoma	9711	–	–	–	–	–	–	1.0	–	–	Not available	
Subtotal											Not available	
Aqueous organic (insufficient quantity or distribution data):												
Synthetic fiber production wastes	2824	.046	.121	.101	.018	.404	.182	.101	–	.027	2×10^{12} (§)	
Dye manufacturing wastes	2865	.015	.170	.156	.047	.156	.111	.265	.020	.060	1×10^{11} (§)	
Nitrile pesticide wastes	2879	.005	.075	.145	.074	.299	.207	.090	.046	.058	2×10^{12} (§)	
Organic arsenicals from production of cacodylates	2879	–	.200	.800	–	–	–	–	–	–	Not available	
Torpedo process wastes	2879	–	–	–	–	–	1.0	–	–	–	Negligible	
Utilities and electrical station waste	49	Not available									3×10^7	
Wastes from production of chloropicrin	9711	–	(‡)	–	–	–	–	(‡)	–	(‡)	Negligible	
Subtotal											3×10^7	
Solid, slurry, or sludge (insufficient quantity or distribution data):												
Wastes from seed industry	011	.017	.088	.371	.213	.053	.060	.081	.023	.094	Not available	
Contaminated orchard soil	0175	.05	–	.15	–	.33	–	.35	.03	.09	Unknown	
Old or contaminated thallium and thallium sulfate rodenticide	2879	.005	.075	.145	.074	.299	.207	.090	.046	.058	Not available	
Highly contaminated soil	9711	–	–	–	–	–	–		1.00	–	3×10^9 (not included in total)	Stored at Rocky Mountain Arsenal
Spent filter media from military operations	9711	Not available									Not available	
Waste chemicals from military	9711	Not available									3×10^5	
Explosives from military ordnance	9711	Not available									4×10^8	
Drugs and contraband seized by customs	–	Not available									Not available	
Etiological materials from commercial production	–	Not available									3×10	
Subtotal											4×10^8	
Total											2×10^{12}	

*This is an updated version of the table that appeared in the first edition of this report.

†NE = New England: Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont; MA = Mid Atlantic: New Jersey, New York, and Pennsylvania; ENC = East North Central: Illinois, Indiana, Michigan, Ohio, and Wisconsin; WNC = West North Central: Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, and South Dakota; SA = South Atlantic: Delaware, District of Columbia, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, and West Virginia; ESC = East South Central: Alabama, Kentucky, Mississippi, and Tennessee; WSC = West South Central: Arkansas, Louisiana, Oklahoma, and Texas; M = Mountain: Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, and Wyoming; W = West (Pacific): Alaska, California, Hawaii, Oregon, and Washington.

‡Exists but quantity is unknown.

§Total liquid discharge for the larger 3-digit standard industrial code category.

¶Percentage for the Mountain and Pacific areas combined is 0.087.

b. The Environmental Protection Agency now estimates total industrial discarded materials generation to be 260 million tons per year (vs. 110 million in 1972). The Environmental Protection Agency's Hazardous Waste Management Division has selected 13 industrial categories for detailed studies of hazardous waste practices (generation, treatment, disposal). Results from eight of the 13 studies are highlighted in Tables I–11 and I–12, below.

i. Discarded materials quantities are listed on both a dry basis (dewatered) and a wet basis (as they are in real situations).

ii. For only the eight industries for which detailed 1975 results are available to date, the total industrial discarded materials generation is 144 million tons per year (dry). This compares to the original estimate (1972 data) for all industry of 110 million tons, and the 1974 estimate for 26 industries of 260 million tons.

iii. Potentially hazardous discarded materials generated annually by the eight industries reported to date total 23 million tons (dry) and 37 million tons (wet—real world). These figures already exceed the Environmental Protection Agency's 1972 estimate of 10 million tons for all industry categories by a factor of two, at least. Amounts from five more industries are yet to be added. And as water and air pollution control systems come on line, these figures will increase in the future.

iv. It can be concluded that the total industrial discarded materials generation rates, and the hazardous discarded materials fraction of that total, are both substantially larger than earlier EPA estimates would indicate.

TABLE I-11.—U.S. INDUSTRIAL WASTE GENERATION (1975 DATA)

[Million metric tons annually]

Industry category	Total, dry	Wastes wet
1. Batteries		
2. Inorganic chemicals	40.000	68.00
3. Organic chemicals, pesticides, explosives	2.200	7.000
4. Electroplating	.909	5.276
5. Paints	.370	.396
6. Petroleum refining	.600	1.300
7. Pharmaceuticals	.244	1.218
8. Primary metals	100.165	117.193
Total (to date)	144.488	200.383

Source: EPA statistics submitted upon subcommittee request, 1976.

TABLE I-12.—HAZARDOUS WASTE QUANTITIES (1975 DATA)

[Million metric tons annually]

Industry	Dry basis	Wet basis
1. Batteries	0.005	0.010
2. Inorganic chemicals	2.000	3.400
3. Organic chemicals, pesticides, explosives	2.150	6.860
4. Electroplating	.909	5.276
5. Paints	.075	.096
6. Petroleum refining	.60	1.300
7. Pharmaceuticals	.062	.065
8. Primary metals	[1] 17.398	[1] 20.356
Total (to date)	23.194	37.363

[1] This figure excludes primary metals industry slag and foundary sand. These wastes also contain potentially hazardous constituents, but were found to leach very small amounts of these constituents. A final decision regarding whether these wastes are hazardous or nonhazardous has not yet been made.

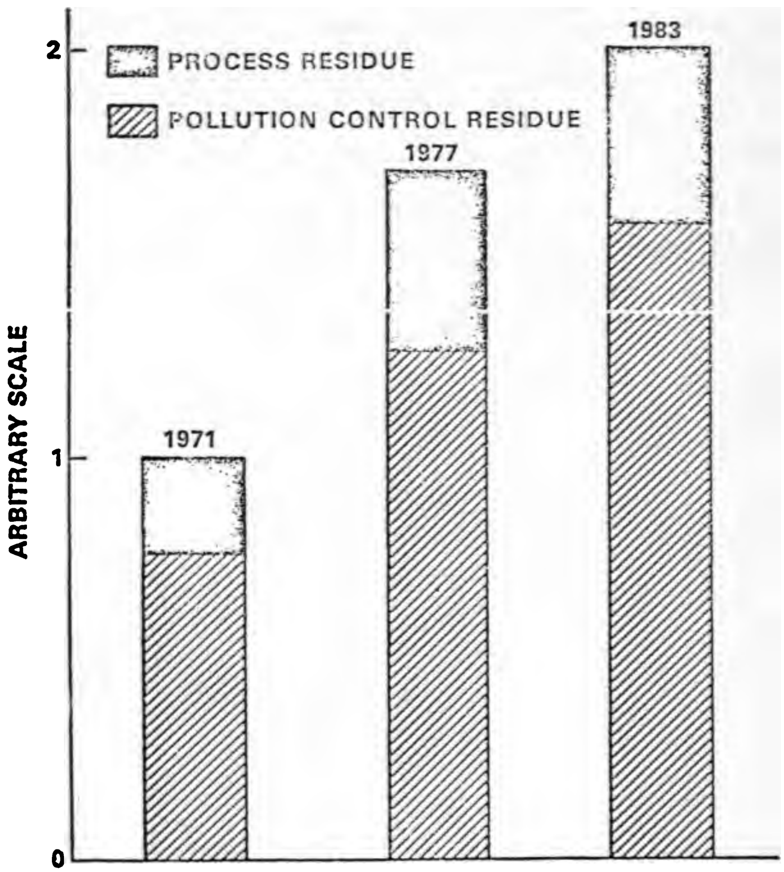
Source: EPA statistics submitted upon subcommittee request, 1976.

v. Table I–13, at page 24, illustrates the estimated growth in industrial discarded materials. It represents the combined total discarded materials and the pollution control residual fraction for four major industries (Inorganic Chemicals, Paper, Steel and Nonferrous Smelting/Refining) in 1971, 1977, and 1983. The total discarded materials increases by 70 percent in 1977 and by 100 percent in 1983. A large part of the increase is due to the anticipated installation of pollution control equipment. Pollution control residuals account for about 75 percent of the total discarded materials in these industries. While all industries may not have this degree of discarded materials growth, the trend is unmistakable.

It is to be borne in mind that the discarded materials in Table I–13 will be competing with all discarded materials for disposal capacity.

PROJECTED GROWTH OF COMBINED WASTE QUANTITIES FOR FOUR REPRESENTATIVE INDUSTRIES (INORGANIC CHEMICALS, PAPER, STEEL, AND NON-FERROUS SMELTING)

Table I-13



Source: EPA statistics submitted upon subcommittee request, 1976.

vi. To gage the impact of the Federal Water Pollution Control Act's Effluent Limitations Guidelines on hazardous waste sludge generation, Environmental Protection Agency has projected hazardous discarded materials amounts from 1974 to 1977 and 1983, when best practicable technology and best available technology levels are to be

implemented. Although the increase in hazardous discarded materials generation varies from industry to industry, depending on the sensitivity of the process waste stream to waste water pollution control requirements, the overall prediction is a hazardous discarded materials growth of 56 percent over the next decade. This figure compares with Environmental Protection Agency's earlier estimated growth of 5 to 10 percent per year.

4. Table I–14, below, illustrates the international status of hazardous discarded materials management.

TABLE I–14.—INTERNATIONAL STATUS OF HAZARDOUS WASTE MANAGEMENT LEGISLATION

Country	Have basic hazardous waste control law	Year enacted	Generator reporting required	Hazardous waste transport safety	Hazardous waste transport tracking (Manifest required)	Treatment control	Land disposal control	State-local Government implementation
1. Belgium	X	1974	X	X	X	X	X	
2. Bulgaria	X	1973	X	X		X	X	
3. Canada	X	1975	X				X	X
4. Czechoslovakia								
5. Denmark	X	1973		X			X	X
6. France	X	1975		X	X	X	X	
7. West Germany	X	1972	X	X	X	X	X	X
8. East Germany	X	1975				X		
9. Netherlands	X	1973	X	X	X	X	X	
10. Poland	X	1972		X		X		
11. Romania	X	1973					X	X
12. Sweden	X	1973	X			X		
13. Switzerland								
14. United Kingdom	X	1972	X	X	X	X	X	X
15. United States				X				
16. U.S.S.R.	X	1972				X	X	

Source: United Nations Economic Commission for Europe Document No. ENV/R.44, Jan. 6, 1976; EPA statistics submitted upon subcommittee request, 1976.

F. STATE ACTION IN DISCARDED MATERIALS MANAGEMENT

1. State commitment to a discarded materials management program

a. Published statewide discarded materials management plans—46 states, 4 territories, and the District of Columbia.

b. Persons employed by state discarded materials management programs—651.

c. Ratio of state discarded materials management staff to 100,000 population—

Maximum=1.83
Average=.31
Minimum=.11

d. State budgets for discarded materials management programs—$12,368,409.

e. Federal budget for support of state programs—$3,000,000.

f. Ratio of state discarded materials management budget to 100,000 population—

Maximum=$0.26
Average=$0.06
Minimum=$0.01

2. State control over land disposal sites

a. Number of states that require permit or license for land disposal—45 states.

b. Percent of state's population served by state-approved landfills—

Maximum=89 percent
Average=50 percent
Minimum=1 percent

e. Number of states with potentially significant leachate problems—31 states.

f. Number of sites where water pollution is a known problem—892.

g. Number of sites in the nation with leachate treatment facilities—61.

3. Hazardous discarded materials management

(The following information is based on 1975 Environmental Protection Agency analysis of state hazardous discarded materials management programs.)

a. At present only about 4 percent of hazardous discarded materials are treated before disposal on land, another 4 percent is recycled.

b. States' share of nation's hazardous discarded materials—2 states contribute 25 percent, 6 states contribute 35 percent, 12 states contribute 25 percent, the remaining 30 states contribute 15 percent.

c. Number of state-approved hazardous discarded materials disposal sites—244.

d. Only five states, California, Illinois, Minnesota, New York, and Oregon, have comprehensive hazardous discarded materials management legislation.

e. There is an interesting lack of correlation between those states which have implemented hazardous discarded materials hauler permit/registration systems on the one hand, and those states which have emphasized better control over hazardous discarded materials at the disposal site on the other. Six of the ten states identified as having hauler permit/registration systems have not designated sites for hazardous discarded materials disposal, while ten of the fourteen states identified as having designated sites have not established hauler permit/registration systems. The four states which have done both are California, Indiana, Massachusetts, and Texas. In each of those states the water pollution control staff (or agency) has major involvement in, or primary control over, both disposal site designation and hauler regulation, even though land disposal is at issue.

f. The states which have failed to designate hazardous discarded materials disposal sites include some of those with the greatest need. Of all the states in Environmental Protection Agency regions I, II, III, and IV, only Massachusetts was reported as having designated hazardous discarded materials disposal sites. These states together account for over 45 percent of the United States population and over 41 percent of the hazardous discarded materials generated annually.

g. The study shows that half the states have assigned one or more persons to work fulltime on hazardous discarded materials management. Many of these people are working on state hazardous discarded materials surveys, and many of these surveys are being conducted with Environmental Protection Agency grant support. At least some of these people will stay with the states as hazardous discarded materials management specialists after the grant period.

h. See Table I–15, at page 28, for a breakdown of information on the state hazardous discarded materials management programs throughout the country, by state and by Environmental Protection Agency regional designation.

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Table I-15

	REGION I	II	III	IV	V	VI	VII	VIII	IX	X	Total Num. of States
Hazardous Waste Legislation		1			1				1	1	4
Regulations Limiting Hazardous Waste Disposal at Landfill Sites				5	2	3		1	3		14
Number of Designated Hazardous Waste Disposal Sites	1				3	3		3	3	1	14
Regulations Designating Hazardous Waste by Element/Compound									1		1
Published Criteria for Designating Hazardous Wastes	1			1					1		3
Hazardous Waste Hauler Registration/Permit System	2	2		2	2	1			1		10
Hazardous Waste Generator Reporting/Permit System											
Hazardous Waste Legislation Pending									2		2
Published Hazardous/Industrial Waste Survey					1				1	3	5
Hazardous/Industrial Waste Survey in Progress			2	1		2	4		3		12
Fulltime Hazardous Waste Staff (Number/Program or Agency Assignment)	5PT/4	2/2	1/1	10/6	2/2 1PT/1	5/2	4/4	3/3 1PT/1	14/3 1PT/3	4/2	45/25 8PT/9

Key:
H = Specific Hazardous Waste Legislation
S = Solid Waste Legislation or Program
PT = Part-time effort by one or more individuals
W = Water Pollution Control Legislation or Program
O = Other Legislation or Program

Source: 1975 EPA Study on State Hazardous Waste Programs Waste Matrix

Table I-15, contd'

Region I

	Connecticut	Maine	Massachusetts	New Hampshire	Rhode Island	Vermont		Total Number of States			
Hazardous Waste Legislation											
Regulations Limiting Hazardous Waste Disposal at Landfill Sites											
Number of Designated Hazardous Waste Disposal Sites			2					1			
Regulations Designating Hazardous Waste by Element/Compound											
Published Criteria for Designating Hazardous Wastes			W					1			
Hazardous Waste Hauler Registration/Permit System	W		W					2			
Hazardous Waste Generator Reporting/Permit System											
Hazardous Waste Legislation Pending											
Published Hazardous/Industrial Waste Survey											
Hazardous/Industrial Waste Survey in Progress											
Fulltime Hazardous Waste Staff (Number/Program or Agency Assignment)	3½PT/S		1PT/W		½PT/S	¼PT/S					

·Key:

H = Specific Hazardous Waste Legislation
S = Solid Waste Legislation or Program
PT = Part-time effort by one or more individuals
W = Water Pollution Control Legislation or Program
O = Other Legislation or Program

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Table I-15, cont'd

Region II

	New Jersey	New York	Puerto Rico	Virgin Islands		Total Number of States					
Hazardous Waste Legislation		yes				1					
Regulations Limiting Hazardous Waste Disposal at Landfill Sites											
Number of Designated Hazardous Waste Disposal Sites											
Regulations Designating Hazardous Waste by Element/Compound											
Published Criteria for Designating Hazardous Wastes											
Hazardous Waste Hauler Registration/Permit System	S	H				2					
Hazardous Waste Generator Reporting/Permit System											
Hazardous Waste Legislation Pending											
Published Hazardous/Industrial Waste Survey											
Hazardous/Industrial Waste Survey in Progress											
Fulltime Hazardous Waste Staff (Number/Program or Agency Assignment)	1/S	1/S				2					

Key:

H = Specific Hazardous Waste Legislation
S = Solid Waste Legislation or Program
PT = Part-time effort by one or more individuals
W = Water Pollution Control Legislation or Program
O = Other Legislation or Program

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Table I-15, cont'd

Region III

	Delaware	District of Columbia	Maryland	Pennsylvania	Virginia	West Virginia		Total Number of States			
Hazardous Waste Legislation											
Regulations Limiting Hazardous Waste Disposal at Landfill Sites											
Number of Designated Hazardous Waste Disposal Sites											
Regulations Designating Hazardous Waste by Element/Compound											
Published Criteria for Designating Hazardous Wastes											
Hazardous Waste Hauler Registration/Permit System											
Hazardous Waste Generator Reporting/Permit System											
Hazardous Waste Legislation Pending											
Published Hazardous/Industrial Waste Survey											
Hazardous/Industrial Waste Survey in Progress	yes		yes					2			
Fulltime Hazardous Waste Staff (Number/Program or Agency Assignment)	1/S							1/S			

Key:

H = Specific Hazardous Waste Legislation
S = Solid Waste Legislation or Program
PT = Part-time effort by one or more individuals
W = Water Pollution Control Legislation or Program
O = Other Legislation or Program

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Table I-15, cont'd

Region IV

	Alabama	Florida	Georgia	Kentucky	Mississippi	North Carolina	South Carolina	Tennessee		Total Number of States	
Hazardous Waste Legislation											
Regulations Limiting Hazardous Waste Disposal at Landfill Sites	O	S			S		S	S		5	
Number of Designated Hazardous Waste Disposal Sites											
Regulations Designating Hazardous Waste by Element/Compound											
Published Criteria for Designating Hazardous Wastes							S			1	
Hazardous Waste Hauler Registration/Permit System				S			S			2	
Hazardous Waste Generator Reporting/Permit System											
Hazardous Waste Legislation Pending											
Published Hazardous/Industrial Waste Survey											
Hazardous/Industrial Waste Survey in Progress					yes					1	
Fulltime Hazardous Waste Staff (Number/Program or Agency Assignment)		1/S	1/S	1/S	2/S		4/S	1/S		6	

Key:

H = Specific Hazardous Waste Legislation
S = Solid Waste Legislation or Program
W = Water Pollution Control Legislation or Program
O = Other Legislation or Program

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Table I-15, cont'd

Region V

	Illinois	Indiana	Michigan	Minnesota	Ohio	Wisconsin		Total Number of States			
Hazardous Waste Legislation	yes			yes				1			
Regulations Limiting Hazardous Waste Disposal at Landfill Sites	S	S						2			
Number of Designated Hazardous Waste Disposal Sites/Authority	1	3				1		3			
Regulations Designating Hazardous Waste by Element/Compound											
Published Criteria for Designating Hazardous Wastes											
Hazardous Waste Hauler Registration/Permit System		W	S					2			
Hazardous Waste Generator Reporting/Permit System											
Hazardous Waste Legislation Pending											
Published Hazardous/Industrial Waste Survey				yes				1			
Hazardous/Industrial Waste Survey in Progress											
Fulltime Hazardous Waste Staff (Number/Program or Agency Assignment)	1/S	1¼PT/S		1/S				2			

Key:

H = Specific Hazardous Waste Legislation
S = Solid Waste Legislation or Program
PT = Part-time effort by one or more individuals
W = Water Pollution Control Legislation or Program
O = Other Legislation or Program

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Table I-15, cont'd

Region VI

	Arkansas	Louisiana	New Mexico	Oklahoma	Texas		Total Number of States				
Hazardous Waste Legislation											
Regulations Limiting Hazardous Waste Disposal at Landfill Sites			S	S	W		3				
Number of Designated Hazardous Waste Disposal Sites			2	2	9		3				
Regulations Designating Hazardous Waste by Element/Compound											
Published Criteria for Designating Hazardous Wastes											
Hazardous Waste Hauler Registration/Permit System					W		1				
Hazardous Waste Generator Reporting/Permit System											
Hazardous Waste Legislation Pending											
Published Hazardous/Industrial Waste Survey											
Hazardous/Industrial Waste Survey in Progress	yes				yes		2				
Fulltime Hazardous Waste Staff (Number/Program or Agency Assignment)			3/S		2/W		2				

Key:
- H = Specific Hazardous Waste Legislation
- S = Solid Waste Legislation or Program
- PT = Part-time effort by one or more individuals
- W = Water Pollution Control Legislation or Program
- O = Other Legislation or Program

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Table I-15, cont'd

Region VII	Iowa	Kansas	Missouri	Nebraska		Total Number of States					
Hazardous Waste Legislation											
Regulations Limiting Hazardous Waste Disposal at Landfill Sites											
Number of Designated Hazardous Waste Disposal Sites											
Regulations Designating Hazardous Waste by Element/Compound											
Published Criteria for Designating Hazardous Wastes											
Hazardous Waste Hauler Registration/Permit System											
Hazardous Waste Generator Reporting/Permit System											
Hazardous Waste Legislation Pending											
Published Hazardous/Industrial Waste Survey											
Hazardous/Industrial Waste Survey in Progress	yes	yes	yes	yes		4					
Fulltime Hazardous Waste Staff (Number/Program or Agency Assignment)	1/S	1/S	1/S	1/S		4					

Key:
H = Specific Hazardous Waste Legislation
S = Solid Waste Legislation or Program
PT = Part-time effort by one or more individuals
W = Water Pollution Control Legislation or Program
O = Other Legislation or Program

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Table I-15, cont'd

Region VIII	Colorado	Montana	North Dakota	South Dakota	Utah	Wyoming		Total Number of States			
Hazardous Waste Legislation											
Regulations Limiting Hazardous Waste Disposal at Landfill Sites		S						1			
Number of Designated Hazardous Waste Disposal Sites	1	1			1			3			
Regulations Designating Hazardous Waste by Element/Compound											
Published Criteria for Designating Hazardous Wastes											
Hazardous Waste Hauler Registration/Permit System											
Hazardous Waste Generator Reporting/Permit System											
Hazardous Waste Legislation Pending											
Published Hazardous/Industrial Waste Survey											
Hazardous/Industrial Waste Survey in Progress											
Fulltime Hazardous Waste Staff (Number/Program or Agency Assignment)	1/S	1/S		1PT/S	1/S			3			

Key:
H = Specific Hazardous Waste Legislation
S = Solid Waste Legislation or Program
PT = Part-time effort by one or more individuals
W = Water Pollution Control Legislation or Program
O = Other Legislation or Program

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Table I-15, cont'd

Region IX

	American Samoa	Arizona	California	Guam	Hawaii	Nevada	Trust Territory		Total Number of States		
Hazardous Waste Legislation			yes						1		
Regulations Limiting Hazardous Waste Disposal at Landfill Sites			W & H		S	O			3		
Number of Designated Hazardous Waste Disposal Sites	1		16			5			3		
Regulations Designating Hazardous Waste by Element/Compound			H						1		
Published Criteria for Designating Hazardous Wastes			H						1		
Hazardous Waste Hauler Registration/Permit System			H						1		
Hazardous Waste Generator Reporting/Permit System											
Hazardous Waste Legislation Pending		yes		yes					2		
Published Hazardous/Industrial Waste Survey			yes						1		
Hazardous/Industrial Waste Survey in Progress		yes	yes			yes			3		
Fulltime Hazardous Waste Staff (Number/Program or Agency Assignment)	½PT/O	1/O	12/H S	½PT/O		1/O	½PT/O		3		

*Key:
H = Specific Hazardous Waste Legislation
S = Solid Waste Legislation or Program
PT = Part-time effort by one or more individuals
W = Water Pollution Control Legislation or Program
O = Other Legislation or Program

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Table I-15, concluded

Region X

	Alaska	Idaho	Oregon	Washington		Total Number of States					
Hazardous Waste Legislation			yes			1					
Regulations Limiting Hazardous Waste Disposal at Landfill Sites											
Number of Designated Hazardous Waste Disposal Sites		1				1					
Regulations Designating Hazardous Waste by Element/Compound											
Published Criteria for Designating Hazardous Wastes											
Hazardous Waste Hauler Registration/Permit System											
Hazardous Waste Generator Reporting/Permit System											
Hazardous Waste Legislation Pending											
Published Hazardous/Industrial Waste Survey		yes	yes	yes		3					
Hazardous/Industrial Waste Survey in Progress											
Fulltime Hazardous Waste Staff (Number/Program or Agency Assignment)			2/S	2/S		2					

Key:
H = Specific Hazardous Waste Legislation
S = Solid Waste Legislation or Program
PT = Part-time effort by one or more individuals
W = Water Pollution Control Legislation or Program
O = Other Legislation or Program

4. Resource recovery activities

a. Number of States with—

i. A grant or loan program for resource recovery=9.

ii. Planning and/or regulation for resource recovery=12.

iii. Operating authorities for resource recovery=5.

iv. Energy recovery systems by 1980=15 (estimate).

G. DAMAGE ASSESSMENT

1. Relationship of land disposal methods and damage mechansims

a. Table I–16 at page 40 represents a preliminary estimate of the relationship between the various land disposal methods and commonly occurring damage mechanisms. The table is based on 311 cases studied to date in an ongoing effort by the Environmental Protection Agency Office of Solid Waste Management Programs to assess the nationwide damages caused by industrial waste land disposal practices. It should be noted that the data summarized in the table are not nationally representative since 57 out of the 311 case studies were obtained from an incomplete survey of Pennsylvania, a state that already has a permit system for landfills and surface impoundments. The most flagrant environmental offenses generally occur in those states that—unlike Pennsylvania—do not have a regulatory program for industrial waste disposal.

Results

1. Nearly 50 percent of the nation is dependent on ground water supplies, and the percentage is growing.

2. Ground water contamination is the most prevalent damage mechanism—nearly twice as frequent as surfacd water contamination.

3. The category of "other land disposal" (e.g. disposing on farmland, spray irrigation, haphazard disposal on vacant lands, etc.) was the major contributor in nearly all of the identified damage mechanisms.

4. A significant number of water supply well contamination cases (37 percent) originated from "other land disposal" and surface impoundments.

5. Leachate from landfills and dumps contributed only to about one-sixth of the well contamination cases.

TABLE I-16.—PRELIMINARY ESTIMATE OF THE RELATIONSHIP BETWEEN DISPOSAL METHOD AND DAMAGE MECHANISM, EXPRESSED AS PERCENT OF CASES STUDIED [1]

Disposal method—Percentage of cases studied	Surface impoundments	Landfills, dumps	Other land disposal [2]	Storage of wastes	Smeltings, slag, mine tailings	Unknown
	23	26	42	6	6	4
Damage mechanism (percentage of cases studied):						
Ground water (64)	18	14	26	1	3	3
Surface water (37)	10	9	13	1	3	1
Air (2)		1	1			
Fires, explosions (2)		1	1			
Direct contact poisoning (10)		2	6	2		1
Unknown (4)	1	1	1	1		1
Well affected [3]	10	6	15	1	2	3

Note: The data presented in this table have been derived solely from case studies associated with land disposal of industrial wastes.

[1] All numbers refer to percent of 311 cases studied thus far. The total percentages in the matrix add up to more than 100, because (1) several damage incidents involved more than 1 disposal method, and (2) several damage incidents involved more than 1 damage mechanism.

[2] Disposing on farmland, spray irrigation, haphazard disposal on vacant lands, etc.

[3] Not included as a damage mechanism.

Source: EPA statistics submitted upon subcommittee request, 1976.

2. Six routes of environmental transport through which improper land disposal of hazardous discarded materials can result in damage

(Information based on 1975 Environmental Protection Agency "Summary of Damage Incidents from Improper Land Disposal")

a. Ground water contamination by way of leachate

i. Approximately 50 percent of the nation's domestic water supplies are derived from underground aquifers, and the quality of these groundwaters is closely related to land disposal practices.

ii. The major perils inherent in ground water contamination are:

(a) the elusive nature and the long duration of the problem.

(b) almost all of the case studies reported to date were discovered after the damage to the ground water had already occurred.

(c) the subsurface migration of pollutants is a very slow process, thus most of the damage caused by the disposal of huge quantities of hazardous wastes during the past decades are still to be evidenced.

(d) once the problem manifests itself, it may take decades or centuries and enormous resources—if the technology is available—to remedy the damage.

iii. Related case studies:

(a) eleven persons developed symptoms of arsenic poisoning from Minnesota well water in an area in which arsenic-containing pesticides had been buried some 35 years before.

(b) toxic cadium and hexavalent chromium found in groundwater in an area where New York electroplating waste waters were dumped in unlined settling pools 18 years earlier.

(c) closing of a large municipal landfill in Delaware after 9 years caused chemical and biological leachates in groundwater 4 years later at a cost of $26 million to remedy. To date, approximately $2 million have been spent on this incident exclusive of administrative and legal costs. This water supply served 40,000 people.

b. Surface contamination by way of runoff

i. Industrial solid discarded materials that are dumped on land ultimately find their way into surface waters through natural runoff.

ii. Improperly lagooned liquid discarded materials of factories, etc., travel to surface streams by overflow or seepage through dikes.

iii. Related case study: (a) drums of industrial discarded materials containing cyanides, arsenic, cadmium, chromium, petroleum products, acids, and miscellaneous other toxic and corrosive materials were dumped on farmland in Illinois. Three cattle died of cyanide poisoning two years later, and it was discovered that surface water runoff indicated a maximum cyanide concentration of 365 ppm. (The U.S. Public Health Service drinking water standard for cyanide is .2 ppm).

c. Air pollution by way of open burning, evaporation, sublimation, and wind erosion

i. Harmful effects of discarded materials dumped on land are transmitted to the environment through the medium of air.

(a) Burning dumps have emitted irritating and toxic fumes and have also caused automobile accidents by creating poor visibility.

(b) Evaporation and sublimation of volatile toxic industrial liquid and solid discarded materials can cause damage to public health and the environment.

(c) Wind erosion of harmful dust from land-disposed discarded materials is an occupational hazard to landfill operators and a danger to nearby residents.

ii. Related case studies:

(a) the land disposal of hexachlorobenzene, a toxic solid by-product in the manufacture of perchloroethylene, dumped on a rural landfill in Louisiana, was absorbed from the air into the body tissues of cattle. Up to 20,000 head of cattle were quarantined causing the ranchers an economic loss of approximately $3.9 million. Sampling and testing alone cost the state and Federal governments over $150,000.

(b) large quantities of volatile organic liquid discarded materials were dumped into a sand and gravel quarry in Maryland resulting in widespread complaints by residents of nauseating fumes.

(c) discarded industrial asbestos materials are frequently land disposed without a soil cover to prevent wind erosion of the harmful fibers whose inhalation can cause asbestosis, lung cancer, mesotheliomas, and pleural lesions in humans. In spite of ample local publicity about the potential hazards, children are still using a playground in Pennsylvania that is located directly adjacent to an inactive 1.5 million cubic yard pile of discarded industrial asbestos materials.

d. Poisoning by way of direct contact

i. This type of poisoning usually occurs when there is a surplus of toxic discarded materials such as pesticides that are not disposed of safely.

ii. Related case studies:

(a) Drums that once had contained various pesticides, including methyl parathion, ethyl parathion, toxaphene and DDT were located approximately 50 feet from a family dwelling on city

property in Arkansas. The residents were urged to use a drum to expedite trash collection. A 2½ year old child, after playing among the drums, was admitted to the hospital suffering from symptoms organophosphate poisoning. Enough concentrate was in evidence of to intoxicate anyone in contact with it.

(b) Empty bags of pesticides were left in a field in Idaho after the contents had been dumped. The bags blew into a cow pasture and fourteen cattle died after licking the bags.

(c) In California, at least 18 persons were hospitalized and two firemen suffered permanently disabling lung damage after inhaling a nematocide emanating from an undepleted 300-pound pressurized canister that had been improperly disposed of by the manufacturer. The canister had been picked up by a man to use as "a nice stand-up fireplace."

e. Poisoning by way of the food chain

i. This is a hazard that is difficult to identify and confirm because there is not enough scientific evidence.

ii. Related case study: (a) Grain that was treated with methyl mercury type seed dressing was fed to some hogs in New Mexico. Three children suffered serious alkyl mercury poisoning after eating pork from these hogs. A pregnant woman who ate the pork gave birth to a baby with congenital mercury poisoning. The relation of this incident to improper land disposal is that some of the grain was dumped at a local dump and scavenged for feed.

f. Fire and explosion

i. Numerous injuries to landfill operating personnel have been caused by fires and explosions due to improper safety precautions, an example of which is the mixing of chemically reactive and mutually incompatible materials, or landfilling of unidentified discarded chemical materials.

ii. Related case study: (a) A bulldozer operator in New Jersey was killed by an explosion at an industrial landfill while burying drums of an unidentified chemical. The victim died of burns which covered 85 percent of his body.

3. Discarded materials storage

The improper storage of discarded materials is the greatest single source of fires in the inner city. Since fires result in a loss of life and in injuries as well as property loss, the improper storage of discarded materials is an indirect safety hazard. (The following examples are from a 1975 Environmental Protection Agency publication, "Relationship of Solid Waste Storage practices in the Inner City to the incidence of rat infestation and fires.")

a. In New York City, 34 percent of all fires in 1972 were attributed to improper discarded materials storage.

b. In Washington, D.C., the condition was even worse that year, with 47 percent of all fires being attributed to improper discarded materials storage.

4. Future environmental damage is expected to grow due to increasing pressures for land disposal

a. Environmental Protection Agency and state authorities are expanding the degree of control on air emissions and water effluents and pesticide use and disposal.

b. Ocean disposal permit conditions are becoming increasingly more stringent.

c. Current pressures for land disposal can be expected to escalate by the mid-1980's when all these regulations take full effect.

H. MATERIALS SHORTAGE

1. Central issues:

a. Resource conservation and the future adequacy of the resource base to sustain desired rates of economic growth.

b. The increasing dependency on foreign sources of crude raw materials and the consequent adverse implications for international balance of payments, strategic self-sufficiency, and international relations.

2. A summary of the historical pattern of U.S. material consumption for broadly defined raw material commodity categories is shown in Table I–17.

TABLE I–17.—U.S. CONSUMPTION OF RAW MATERIALS, 1900–69

Year	All raw material	Food material	Nonfood agricultural and forestry products	Energy material [1]	Metallic minerals	Other nonfuel minerals
Annual value [millions of dollars (1967)]: [2]						
1900	17,358	10,448	3,347	2,447	594	499
1929	31,979	16,834	5,608	6,508	1,663	1,179
1949 [3]	44,357	22,279	7,017	10,167	2,648	1,618
1959	53,737	26,411	6,987	13,295	3,212	3,046
1969	68,590	32,275	7,431	19,170	4,046	4,338
Increase (percent):						
1909–29	43	31	27	94	71	136
1929–49	39	32	25	56	59	37
1949–59	21	19	0	31	21	88
1959–69	28	22	6	44	26	42
1949–69	55	45	6	89	53	168
1900–69	295	209	120	683	581	769

[1] Includes wood burned as fuel.
[2] Spencer, V. E. Raw materials in the United States economy: 1900–1969. Working Paper 35. Washington, U.S. Bureau of the Census, July 1972. 66 p.
[3] 1948 and 1950 values are averaged here to minimize the effect of the 1949 recession year influence on consumption growth trends.

Source: 1974 EPA Second Report to Congresss.

a. The annual value of all raw materials consumed has virtually quadrupled since 1900. The greater part of this increase is accounted for by food and energy raw materials, which together tend to dominate the absolute value magnitudes.

b. The mineral groups have exhibited the most rapid rates of increase; the slowest growth has been in the forestry products and nonfood agricultural group.

c. Not only are the absolute quantities growing rapidly for most categories of crude raw materials, but there is also some evidence that even the percent growth rates have been increasing over the recent past.

d. A comparison of crude raw material consumption with Gross National Product (GNP) shows that crude and semi-processed raw materials currently contribute a relatively small proportion to the Gross National Product, and this contribution has been decreasing continuously since at least 1929—down from 13.4 percent in 1929, to 10 percent in 1959, to 8 percent in 1969. Thus, in spite of the

rapid growth in raw material consumption, the Gross National Product has expanded at an even more rapid pace.

3. Table I–18 below summarizes the results of extrapolating historical growth trends to the years 1980, 1985, 1990, and 2000. Two alternative projections are made for each year, a "high" value, based on the individual category's 1959–69 growth rate experience, and a "low" value, based on its longer term 1929–69 growth rate.

TABLE I–18.—PROJECTED GROWTH FACTORS FOR GNP, PERSONAL CONSUMER EXPENDITURES, AND RAW MATERIAL CONSUMPTION

Item	Growth factor [1]							
	1980		1985		1990		2000	
	High	Low	High	Low	High	Low	High	Low
GNP	1.40	1.29	1.73	1.51	2.13	1.76	3.25	2.42
Personal consumer expenditures:								
Durable goods	1.72	1.39	2.41	1.71	3.38	2.10	6.65	3.16
Nondurable goods	1.29	1.24	1.51	1.41	1.76	1.62	2.42	2.11
Total	1.41	1.28	1.75	1.49	2.21	1.73	3.34	2.35
Material consumption:								
All raw material	1.22	1.16	1.38	1.28	1.56	1.40	2.00	1.69
Metallic minerals	1.20	1.19	1.34	1.33	1.51	1.48	1.98	1.84
Nonfuel, nonmetallic minerals	1.33	1.30	1.58	1.53	1.89	1.79	2.69	2.48
Energy material	1.34	1.24	1.60	1.41	1.92	1.62	2.77	2.11
Nonfood agricultural and forestry products	1.05	1.06	1.08	1.09	1.11	1.13	1.18	1.22
Food material	1.17	1.14	1.29	1.23	1.43	1.33	1.74	1.56
Population [2]	1.07		1.13		1.18		1.27	

[1] The projected ratio of the future year value to the 1972 (base year) value.
[2] Based on the most recent U.S. Department of Commerce Bureau of the Census Series E population projections.

Source: 1974 EPA Second Report to Congress.

a. Gross National Product is expected to reach 3,25 times ints 1972 level (or an increase of 225 percent) in real terms by the year 2000 under the high growth rate assumption or 2.42 times its 1972 level (an increase of 142 percent) under the low growth rate assumption.

b. The projections for consumer or household sector total personal consumption closely follow those for the Gross National Product with durable goods growing substantially faster and nondurable goods somewhat less rapidly.

c. On the basis of past performance, raw material consumption should grow proportionately less rapidly than either the Gross National Product or the household final demand component of Gross National Product.

d. Annual consumption of raw materials would double by the end of the century under the high growth assumption, or increase by about 70 percent under the low growth projection.

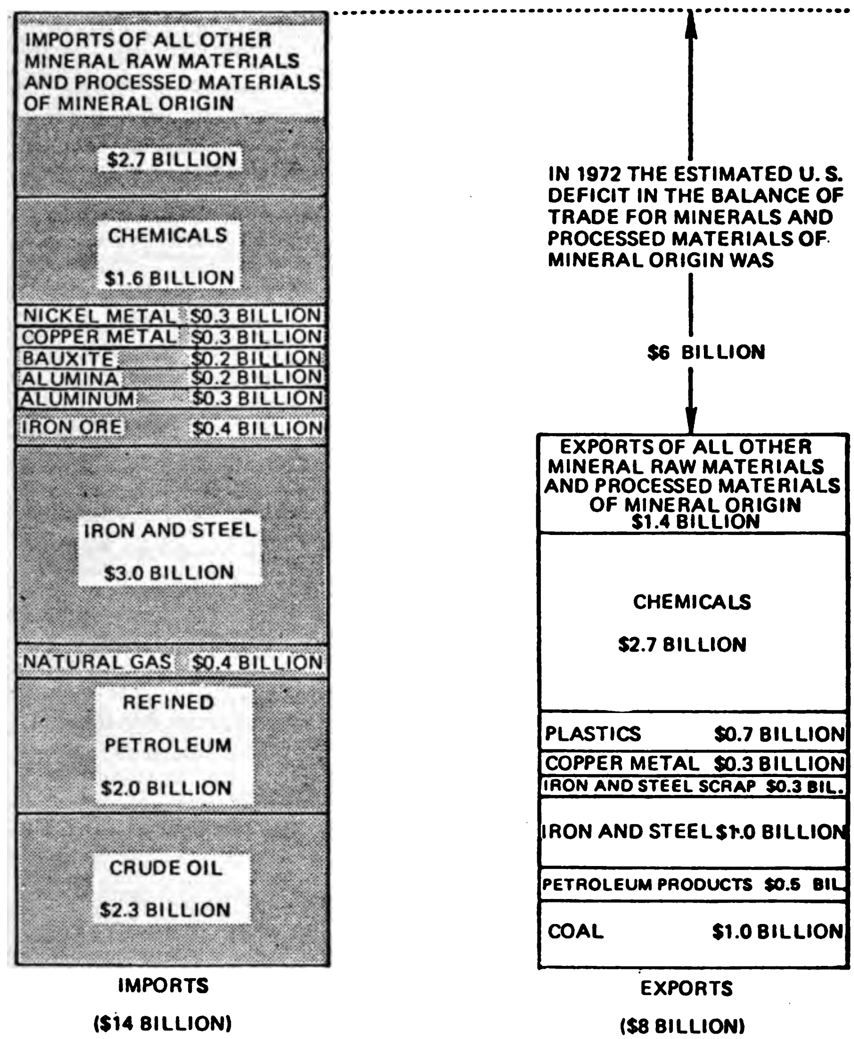
e. In summary, this rate of economic growth implies, by the year 2000, an increase in overall U.S. demands on the so-called "renewable" agricultural and forestry resources of 50 percent or more and on mineral deposits of about 2.5 times our present consumption rate.

4. Today United States dependence on foreign minerals is already high and translates into a large outflow of gold ($8 billion in 1970). By 1985, according to Department of the Interior estimates, the mineral deficit will have reached $32 billion, 1.8 percent of the Gross National Product, up from 0.8 percent in 1970.

a. The United States does not possess known commercial-scale deposits of some raw materials (such as tin and nickel), and that for some others (such as iron ore) most of U.S. higher grade and more accessible deposits have already been largely depleted.

b. See Table I–19, below, for an indication of the impact of mineral imports on the United States balance of payments (source: "Final Report of National Commission on Materials Policy," p. 2–26).

TABLE I–19.—U.S. imports exceed exports of raw and processed minerals



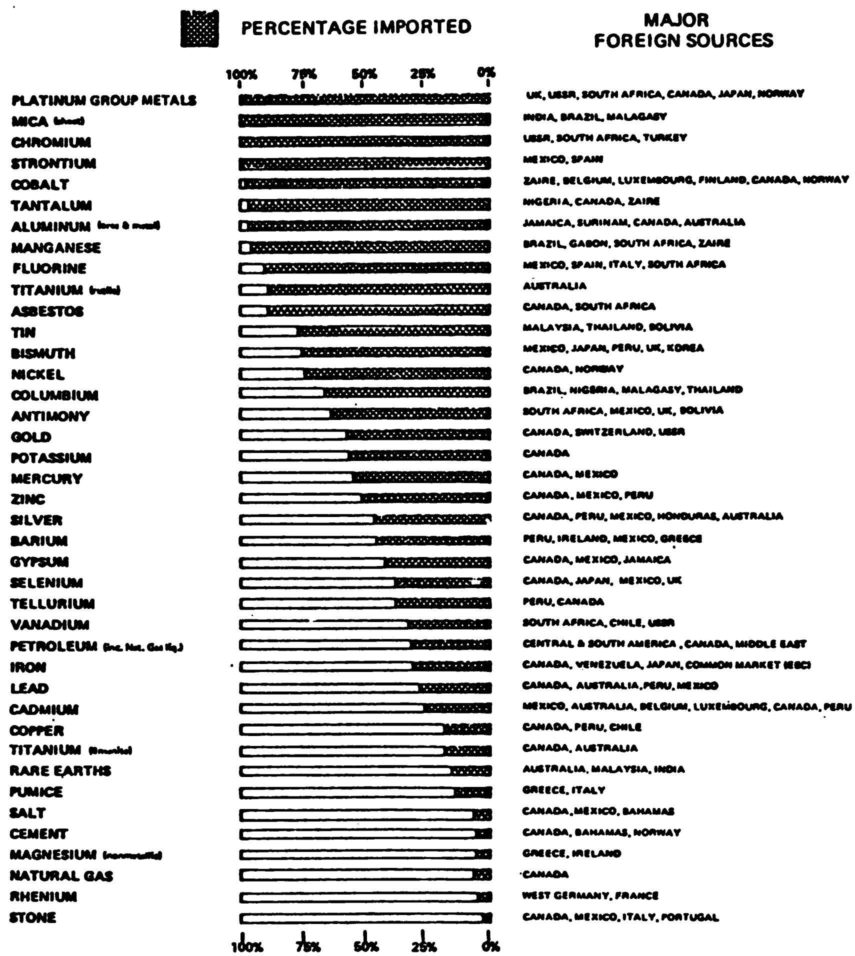
THE IMPACT OF MINERAL IMPORTS ON THE U.S. BALANCE OF PAYMENTS

Table I–19. Studies by the U.S. Department of the Interior indicate that if present trends continue, the value of U.S. primary mineral requirements in excess of the value of U.S. primary mineral supplies will increase to about $100 billion by the year 2000 (prices in 1971 dollars). About half of this estimated deficit will be for energy materials, and the balance for other minerals. Source: Bureau of Mines, U.S. Department of the Interior, 1973.

Source: 1973 Final Report of National Commission on Materials Policy.

c. See Table I–20, below, for an illustration of percentage of United States mineral requirements imported during 1972 ("Final Report", p. 2–25.)

TABLE I–20.—Percentage of U.S. mineral requirements imported during 1972



THE INTERNATIONAL SCOPE OF THE MATERIALS SYSTEM

Table I–20. The United States imported varying amounts of metal, nonmetallic, and fuel minerals from more than 40 countries or areas of the world in 1972. No major nation of the world is completely self-sufficient in all the minerals required to sustain an industrialized economy. Source: Bureau of Mines, U.S. Department of the Interior, 1973.

Source: 1973 Final Report of National Commission on Materials Policy.

5. Two viewpoints regarding the future adequacy of the natural resource supplies:

a. Economic catastrophe must inevitably overtake us at some future time as high-grade mineral deposits become successively exhausted, low-grade deposits become increasingly costly to discover

and exploit, and the upper limits of sustained-yield resources are achieved.

b. Maintaining high per capita growth rates of material consumption depends primarily on human ingenuity. Present knowledge of the extent of mineral deposits is infinitesimal compared with the unexplored reaches of the planet. Limits are those imposed by human knowledge, technology and economic organization.

6. Although individual materials may be limited, the functional characteristics for which any given material is employed is regarded in principle as potentially available in other materials.

7. Economic system is seen as capable of devising entirely different final products to serve traditional demands or uses.

8. Given these facts, Environmental Protection Agency states it is difficult to identify any specific natural resource commodity that is essential or critical in any absolute sense or to identify any nonreplenishable resources that are exhaustible.

9. The current shortages of energy and materials should serve to illustrate that even if the resource base is adequate, acquisition of materials can be accompanied by severe short-term dislocations and social costs.

10. A number of areas of considerable uncertainty and risk regarding long-term future virgin resource supplies:

a. The extent of future mineral discoveries and the cost of exploiting them. Continued high and growing rates of resource consumption could well force use of lower grade ores or energy materials at high extraction costs.

b. Future growth rates of world market demands, especially of the presently underdeveloped nations of the world, and increasing competition for many commodities on world markets.

c. Geopolitical events that could significantly affect the United States position in international markets for particular commodities or cause unusual demands on United States exports.

11. It must be borne in mind that there are community and regional disruption costs associated with industry relocation due to dynamic change in raw material types and sources. These are seldom if ever factored into the private market pricing calculus as future social costs of natural resource supply.

12. The exploitation of low-grade resources (e.g., shale oil versus crude oil) is generally accompanied by external environmental costs (such as bulk shale oil residues, which require large land area for disposition).

13. Three summary directives from the "1973 Final Report of the National Commission on Materials Policy," which the Commission believes will move the nation toward meeting the challenges of securing a sufficient supply of materials while managing and conserving the physical basis of United States national life, are:

a. "Strike a balance between the 'need to produce goods' and the 'need to protect the environment' by modifying the materials system so that all resources, including environmental, are paid for by users.

b. "Strive for an equilibrium between the supply of materials and the demand for their use by increasing primary materials production and by conserving materials through accelerated discarded materials recycling and greater efficiency-of-use of materials.

c. "Manage materials policy more effectively by recognizing the complex interrelationships of the materials—energy—environment system so that laws, executive orders, and administrative practices reinforce policy and not counteract it." ("Final Report," p. 1–4).

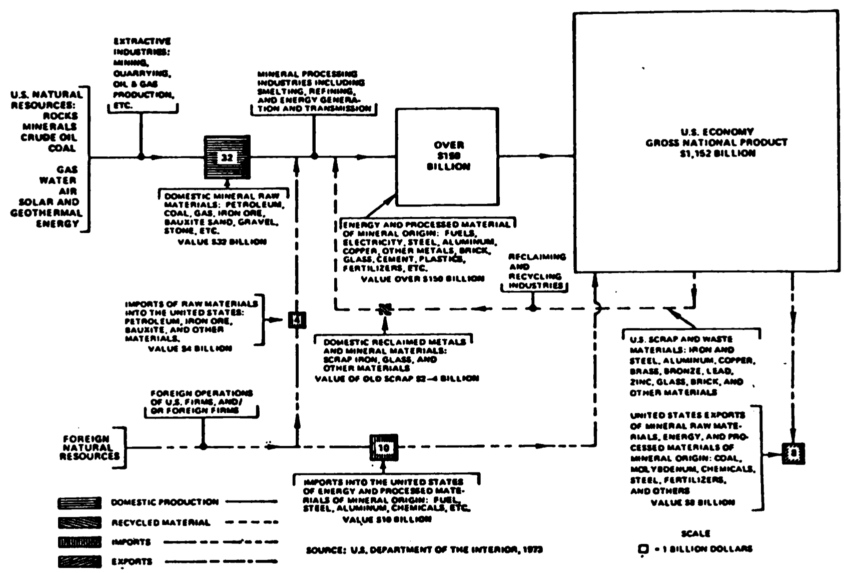
14. In addition the Commission "considers resource recovery among the highest national priorities and encourages the Congress and the Executive Branch to establish recycling as an explicit national goal." ("Final Report," p. 1–7).

15. See Table I–21, below for a scale drawing of the relative importance of domestic mineral raw materials, imports, exports, and processed and recycled materials to the Gross National Product for 1972 ("Final Report," p. 2–2).

TABLE I–21

THE ROLE OF MINERALS IN THE U.S. ECONOMY

(ESTIMATED VALUES FOR 1972)



Source: 1974 EPA Second Report to Congress.

THE FLOW OF MINERAL MATERIALS THROUGH THE U.S. ECONOMIC SYSTEM

Table I–21 Basic mineral materials, including metals, nonmetallics, and fuels, constitute only about 3 percent of the Gross National Product. As these materials are processed, their value is multiplied nearly 5-fold by inputs of labor, capital, productivity, and enterprise. The areas of the squares, drawn to dollar scale, put into focus the respective segments of the economy. Source: Bureau of Mines data, U.S. Department of the Interior, 1973. Reference (1).

I. EXISTING FEDERAL POLICIES CONCERNING VIRGIN AND SECONDARY MATERIAL USE

1. *There are three major Federal policies that affect material use*

a. Freight rate regulations for virgin and secondary commodities.

b. Federal procurement specifications for products containing recycled materials.

c. Tax benefits for various virgin material industries.

2. Freight rates for virgin and secondary materials

a. The current controversy concerning freight rates for secondary materials centers around the issue of discrimination.

b. To demonstrate discrimination against secondary material, it must be shown that the rate relationship between virgin and secondary materials is the source of actual injury to shippers of secondary material. This essentially requires demonstration that current rates for secondary material are too high relative to the rates for virgin material and that, as a result, there is a decrease in recycling.

c. Section 204 entitled "Investigation of discriminatory freight rates for the transportation of recyclable or recycled materials" is contained in the Railroad Revitalization and Regulatory Reform Act of 1976 (PL 94–210) signed into law February 5, 1976.

3. Federal procurement of products containing recycled materials

a. The potential for Federal procurement to develop market demand for recovered resources.

i. Of the $66 billion in direct Federal procurement in 1970, $53.4 billion was defense and $12.6 billion was nondefense-related (Environmental Protection Agency "Second Report to Congress")

ii. Federal expenditures that represent a large percent of the domestic market for a commodity fall mainly in defense-related areas: ordnance, 75 percent; explosives, 48 percent; aircraft 41 percent; communication equipment, 31 percent; ships, trains, trailers, and cycles, 19 percent; nonferrous ore mining, 19 percent; and industrial organic chemicals, 11 percent.

iii. Many defense-related commodities represent special purpose equipment for which secondary material utilization would not be suitable.

iv. Table I–22 below illustrates direct Federal procurement expenditures as a percent of domestic output of that commodity in 1970.

TABLE I–22.—DIRECT FEDERAL PROCUREMENT EXPENDITURES AS A PERCENT OF DOMESTIC OUTPUT OF THAT COMMODITY, 1970

Commodity	Defense	Nondefense†	Total
Ordnance	55.63	19.39	75.02
Explosives	45.52	2.32	47.84
Aircraft and parts	35.26	5.26	40.52
Communication equipment	27.47	3.96	31.43
Ships, trains, trailers, and cycles	14.84	4.06	18.90
Nonferrous ore mining	18.10	.51	18.61
Industrial organic chemicals	10.69	.52	11.21
Instruments and clocks	7.04	2.28	9.32
Electronic components	7.65	1.17	8.82
Office supplies	4.28	3.57	7.85
Engines and turbines	5.69	.99	6.68
Maintenance construction	3.86	2.69	6.55
Industrial gases	3.37	3.06	6.43
Batteries and X-ray and engineering electronic equipment	5.31	.82	6.13
Office computing and accounting machines	4.36	1.67	6.03
Electric apparatus and motors	4.88	.91	5.79
Optical and photographic equipment	3.43	1.96	5.39
General industrial machines and equipment	4.72	.41	5.13
Materials and handling equipment	4.54	.50	5.04
Industrial inorganic chemicals	3.76	----------	3.76
Biological products	1.03	2.72	3.75
Petroleum refining	3.35	.31	3.66
Gum and wood chemicals	.03	3.58	3.61
Miscellaneous rubber products	3.35	.17	3.52
Construction and mining machinery and equipment	2.74	.18	2.92
Truck trailers	2.40	----------	2.40

TABLE I–22.—DIRECT FEDERAL PROCUREMENT EXPENDITURES AS A PERCENT OF DOMESTIC OUTPUT OF THAT COMMODITY, 1970—Continued

Commodity	Defense	Nondefense †	Total
Household textiles and upholstery	1.96	.23	2.19
Machine shops and miscellaneous machinery	2.00	.06	2.06
Office furniture	.67	1.26	1.93
Pharmaceutical preparations	.98	.88	1.86
Commercial printing	2.69	(−.85)	1.84
Motor vehicles and parts	1.57	.16	1.73
Coal mining	1.42	.24	1.66
Metalworking machinery and equipment	1.22	.40	1.62
Chemical preparations	1.40	.10	1.50
Tire and inner tubes	1.42	.08	1.50
Cellulosic man-made fibers	1.38	----	1.38
Dairy products	.69	.67	1.36
Agricultural, forestry, and fishery products	1.31	.01	1.32
Polishes and sanitation goods	.87	.40	1.27
Service industry machines	1.08	.09	1.17
Fertilizers	.03	1.09	1.12
Fiber cans	1.12	----	1.12
Wooden containers	1.08	.01	1.09
Grain mill products	.08	.87	.95
Inorganic pigments	.92	----	.92
Iron and ferro alloy ore mining	1.70	(−.79)	.91
Sanitary paper products	.34	.56	.90
Agricultural chemicals	.34	.39	.73
Primary and secondary aluminum	.63	.03	.66
Wood preserving and miscellaneous products	.42	.23	.65
Miscellaneous plastic products	.53	.09	.62
Structural metal products	.51	.09	.60
Medicinals and botanicals	.58	----	.58
Noncellulosic organic fibers	.58	----	.58
Stampings, screws, machine products, and bolts	.44	.13	.57
Meat packing	.42	.14	.56
Hardware plating, wire products, and valves	.38	.17	.55
Special industrial machinery	.28	.27	.55
Coated and converted paper	.32	.21	.53
Papermill products	.13	.40	.53
Plastics materials and resins	.51	----	.51
Soap and other detergents	.42	.09	.51
Household furniture	.23	.27	.50
Glass and glass products	.28	.21	.49
Rubber footwear	.46	----	.46
Apparel	.26	.17	.43
Farm machinery and equipment	.36	.04	.40
Electric lighting and wiring equipment	.37	.02	.39
Primary and secondary copper	.08	.30	.38
Cyclic intermediates and crudes	.35	----	.35
Miscellaneous food products	.05	.30	.35
Cardboard boxes	.23	.09	.32
Rugs, tire cord, and miscellaneous textiles	.21	.11	.32
Book printing and publishing	1.19	(−.88)	.31
Synthetic rubber	.31	----	.31
Fabrics and yarn	.29	----	.29
Metal containers	.29	----	.29
Canned and frozen goods	.17	.10	.27
Stone and clay products	.34	(−.07)	.27
Primary and secondary iron and steel	.20	.01	.21
Bakery products	.13	.07	.20
Household appliances	.16	.04	.20
Corrugated and solid fiber boxes	.12	.05	.17
Shoes and other leather products	.11	.02	.13
Sugar	.09	.04	.13
Beverages	.09	.03	.12
Paints and allied products	.08	.04	.12
Paperboard mill products	.09	.03	.12
Stone and clay mining and quarrying	.42	(−.31)	.11
Miscellaneous manufactured products	.12	(−.02)	.10
Leather tanning	.06	.02	.08
Chemical and fetilizer mineral mining	.05	.01	.06
Confectionary and related products	.03	.02	.05
Livestock	----	.02	.02
Newspapers	.01	.01	.02
Periodicals	.01	----	.01
Sawmill and planning mill products	----	----	1
Toilet preparations	----	----	----

† Negligible.

Source: 1974 EPA Second Report to Congress.

v. Commodities that have a significant potential for secondary material content: paper and paperboard products, iron and steel nonferrous metals, glass products, plastics, and rubber products.

vi. Although the Federal Government is a large single consumer, Federal expenditures represent a small fraction of combined industrial, commercial, and personal expenditures in these areas.

vii. Though Federal purchases of waste-based products would be small, Federal procurement specifications are widely circulated and duplicated by state and local governments and some industries.

b. Previous attempts to incorporate recycled materials into federally purchased products:

i. In Executive Order 11514, March 1970, the President directed Federal agencies to "initiate measures needed to direct their policies, plans and programs so as to meet national environmental goals."

ii. General Services Administration recycled paper procurement programs:

(a) paper procurement specifications were adjusted to require various percents of recycled fiber in two parts: the first part specifies the required percent of recycled fiber from post-consumer discarded materials sources (e.g., newspapers, magazines, and all fibrous materials recycled from municipal discarded materials) and the second part specifies how much may be derived from converting and fabrication discarded materials (e.g. envelope cuttings, paper trimmings, and other papermill and textile mill discarded materials).

(b) The General Services Administration utilizes 144 different paper specifications. In fiscal 1972 it purchased $88 million in paper products. To date 77 specifications, representing $56.6 million in purchases, have been changed to require some percent of reclaimed fibers.

(c) Table I-23 summarizes the purchases in various paper commodity areas along with the ranges of post-consumer discarded materials and other recycled fibers.

TABLE I-23.—SUMMARY OF RECYCLED FIBERS REQUIRED IN GENERAL SERVICES ADMINISTRATION PROCUREMENTS, FISCAL 1972[1]

Commodity	Purchases (millions)	Reclaimed fibers (percent)	Post consumer waste fibers (percent)
Building materials	$0.2	40	30
Office supplies	17.5	15–100	0–75
Packaging	19.5	3–100	0–90
Tissue	19.4	20–95	5–35
Total	56.6		

[1] Data provided by the General Services Administration.

Source: 1974 EPA "Second Report to Congress."

iii. Department of the Army retread tire program:

(a) The Department of the Army has exercised a program of retreading automobile and truck tires since World War II.

(b) Retreading has substantial cost advantages, e.g., a 50 percent cost saving can be achieved by retreading a tire rather than purchasing a new replacement.

(c) The Army's present goal is to retread 75 percent of the tires it replaces.

(d) Extending this practice to other agencies involves issues of tire safety and performance.

iv. Joint Committee on Printing use of secondary fibers in printing and publishing papers:

(a) The Joint Committee on Printing is responsible for specifications for all stationery, printing, and publishing paper used by the Federal Government.

(b) The Environmental Protection Agency has been using recycled fibers on an experimental basis. Program is being evaluated.

c. Barriers to expanded use of recycled materials in Federal purchases:

i. Uncertainty regarding the technical performance of products supplied.

ii. Uncertainty as to the availability of secondary materials.

iii. Budgetary constraints arise from the fact that for many products it is more expensive to use secondary than virgin material. In the General Services Administration paper program, however, higher prices were not offered for products containing higher percents of recycled fiber.

d. The Environmental Protection Agency concludes in its "Second Report to Congress" that Federal procurement can serve a valuable function in helping to establish the technical and economic factors of recycled material use.

4. Tax benefits for virgin materials

a. Depletion allowance.—The depletion allowance is a tax deduction based on the depletion of a mineral deposit. There are two methods for calculating depletion allowance: the percentage method and the cost method. Each year the method providing the larger deduction is used. Though the cost depletion provides for the recovery of the investment required to exploit a mineral deposit, the tax benefit is the excess of the percentage depletion allowance above the cost depletion allowance.

b. Expensing of capital expenditures.—This provision allows the costs of development, improvement, or other increases in the value of minerals and timber to be deducted from income in the year they are incurred instead of being added to the cost of the asset and recovered over time through depreciation or depletion.

c. Capital gains treatment.—Instead of being taxed at ordinary income tax levels at the time of sale (up to 48%) the income received from the sale of timber is subject instead to capital gains tax treatment. This special allowance for the sale of timber reduces the payments from the ordinary 48% rate to the 30% capital gains tax rate. In the case of coal and domestic iron ore, if after disposing of a commodity an economic interest is retained and royalties are received, such royalties are also eligible for capital gains treatment.

d. Foreign tax allowances.—There are several special tax provisions available to U.S. firms with foreign based operations. Because many U.S. firms in the virgin material business own foreign holdings, these provisions provide a benefit not available to domestic secondary material firms. Four foreign tax benefits have been identified: the

foreign tax credit, the exclusion for less-developed country corporations, the exclusion for controlled foreign subsidiaries, and the Western Hemisphere trade corporation deduction.

e. Foreign tax credit.—Firms operating outside the United States can deduct foreign taxes directly from their U.S. tax liability. The foreign tax credit is available to U.S. timber and mining firms operating in foreign nations.

f. Exclusion for less-developed country corporations.—For virgin material firms operating in countries defined by the President as "less developed", there is an alternative method allowed for determining the amount of foreign tax credits available to offset U.S. taxes that increases the value of the tax credit to the U.S. firm.

g. Exclusion for controlled foreign subsidiaries.—For certain firms that do not repatriate foreign earnings, a deferral of U.S. taxes is allowed.

h. Western Hemisphere Trade Corporation.—For firms operating within the Western Hemisphere, there is a method of calculating U.S. tax owed that reduces the taxes payable by about one-third.

i. See Table I–24 at page 54 for comparison of virgin material tax benefits and prices (Environmental Protection Agency "Second Report to Congress", 1974).

TABLE I-24.—COMPARISON OF VIRGIN MATERIAL TAX BENEFITS AND PRICES

Product	Tax saving per unit of production	Maximum material price effect of tax saving [1]	Raw material price (1969–70)	(3)+(4)	Processed material price [2] (1969–70)	(3)+(6)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Timber (used for paper)	$0.899 per ton	$1.80 per ton	$9 per ton stumpage	0.20	$130 per ton dry pulp.[3]	0.01
Petroleum	$0.350 per barrel	$0.70 per barrel	$3.90 per barrel crude oil at wellhead	.23	$4.62 per barrel, No. 2 fuel oil.[4]	.15
Natural gas	$0.022 per 1,000 cu ft	$0.044 per 1,000 cu ft	$0.167 per 1,000 cu ft gas at the wellhead	.26	$0.551 per 1,000 cu ft, delivered to consumer.[4]	.08
Bauxite (used for aluminum)	$1.496 per ton	$3 per ton	$14 per ton bauxite	.21	$544 per ton aluminum.[5]	.04
Sand (used for glass)	$0.082 per ton	$0.15 per ton	$2.38 per ton at quarry	.07	$20 per ton molten glass.[6]	.01
Iron ore	$0.748 per ton	$1.50 per ton	$10.84 per ton at mine	.14	$41 per ton molten pig iron.[7]	.06
Coal	$0.142 per ton	$0.28 per ton	$5 per ton at mine	.06		

[1] Assuming entire saving is reflected in material price and firm is in the 48 percent income tax bracket.
[2] Most probable point of competition between virgin and secondary materials.
[3] The demand and price of timber 1971–72. "Official Board Markets," 1970.
[4] U.S. Bureau of Mines; 1969 Minerals yearbook, vol. 1. Washington, U.S. Government Printing Office, 1970.
[5] Approximately 8 tons of bauxite are required for 1 ton of aluminum. U.S. Bureau of Mines. Mineral facts and problems. Washington, U.S. Department of the Interior, 1970.
[6] Darnay, A., and W. E. Franklin. Salvage markets for materials in solid wastes. Washington, U.S. Government Printing Office, 1972, 187 pp.
[7] Approximately 1.6 tons of iron ore and 0.85 ton of coal are required for 1 ton of molten pig iron. Molten pig iron price from Midwest Research Institute. Economic studies in support of policy formation on resource recovery. Unpublished report to the Council on Environmental Quality, 1972.

Source: EPA 1974 "Second Report to Congress."

j. See Table I–25 below for comparison of virgin material tax benefits with virgin and secondary material product cost differential.

TABLE I–25.—COMPARISON OF VIRGIN MATERIAL TAX BENEFITS WITH VIRGIN AND SECONDARY MATERIAL PRODUCT COST DIFFERENTIAL

Product	Product cost [1]		Cost differential in favor of virgin material	Tax benefit as a percent of virgin and secondary material cost differential
	Using virgin material (per ton)	Using secondary material (per ton)		
Glass	$18.50	[2] $16.00–20.50	–$1.50–2.00	0–8
Steel (molten pig iron) [3]	40.50	43.00	2.50	106
Paper: [4]				
Linerboard (100 percent virgin fiber compared with 25 percent secondary paper)	78.50	81.00	2.50	72
Corrugating medium [85 percent virgin (semi-chemical) compared with 35 percent secondary (semichemical)	79.50	82.00	2.50	72
Combination boxboard:				
100 percent virgin (kraft) compared with 100 percent secondary (newsback)	152.50	155.50	3.00	60
100 percent virgin (kraft) compared with 100 percent secondary (whiteback)	152.50	174.50	22.00	8
Printing and writing paper (100 percent virgin compared with 100 percent secondary)	92.00	99.00	7.00	26

[1] Cost at the point in processing where virgin and secondary materials are equivalent inputs. Midwest Research Institute. Economic studies in support of policy formation on resource recovery. Unpublished report to the Council on Environmental Quality, 1972.
[2] Cost data modified by EPA analysis of current technology and expected transportation distances.
[3] Iron ore and coal benefits only. (Benefits to limestone, which is also required to produce steel, are excluded.)
[4] Cost data modified from Franklin, W. E. Paper recycling; the art of the possible. Washington, American Paper Institute, 1973.

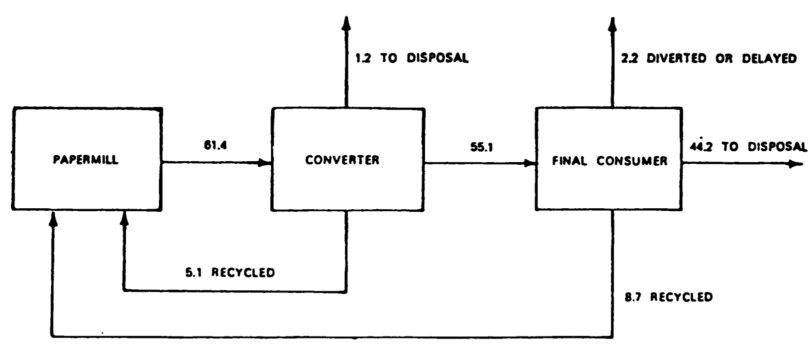
Source: 1974 EPA "Second Report to Congress."

II. Materials Recovery

A. PAPER

1. In 1973 61.4 million tons of paper and board (excluding construction grades) were consumed in the U.S. 44.2 million tons of it entered the solid discarded materials stream and were disposed of (See Table II–1 for illustration of paper flow estimated for 1973).

TABLE II–1



This shows the flow of paper from the mills through to disposal, estimated for 1973. Based on statistics compiled by the American Paper Institute as reported in *Statistics of Paper and Paperboard, 1974*. New York, American Paper Institute, July 1974. 70 p.

Source: 1975 EPA 3d report to Congress.

2. 14 million tons of paper were recycled in 1973:

a. 8.7 million tons—post-consumer municipal solid discarded materials (recovery rate of 16.4 percent).

b. 5 million tons—wastepaper recovered from the 6 million tons generated in industrial converting operations (recovery rate of over 80 percent).

3. See Table II-2 below for illustration of domestic paper recycling rate from 1944 to 1973. This table indicates a steady decline in the recycling rate.

TABLE II-2.—DOMESTIC PAPER RECYCLING RATE: 1944-73

Year	Total paper consumption (thousand tons)	Wastepaper consumption (thousand tons)		Recycling rate based on—	
		Census data [1]	Industry data [2]	Census data	Industry data
1944	19,445	6,859		35.3	
1945	19,665	6,800		34.6	
1946	22,510	7,278		32.3	
1947	24,749	8,009		32.4	
1948	26,083	7,585		29.1	
1949	24,695	6,600		26.7	
1950	29,012	7,956		27.4	
1951	30,561	9,070		29.7	
1952	29,017	7,881		27.2	
1953	31,360	8,531		27.2	
1954	31,379	7,857		25.0	
1955	34,719	9,041		26.0	
1956	36,495	8,836		24.2	
1957	35,270	8,493		24.1	
1958	35,119	8,671		24.7	
1959	38,725	9,414		24.3	
1960	39,138	9,031		23.1	
1961	40,312	9,018		22.4	
1962	42,216	9,075		21.5	
1963	43,715	9,613		22.0	
1964	46,385	9,843		21.2	
1965	49,102	10,231		20.8	
1966	52,680	10,564		20.1	
1967	51,944	9,888		19.0	
1968	55,664	10,222		18.4	
1969	58,915	10,939	11,969	18.6	20.3
1970	57,940	10,594	11,800	18.3	20.4
1971	59,557	11,000	12,100	18.5	20.3
1972	64,386	11,703	12,915	18.2	20.1
1973	67,240	12,374	13,880	18.4	20.6

[1] U.S. Bureau of the Census. Pulp, paper, and board: 1973. "Current Industrial Reports Series M26A(73)-13," Washington, U.S. Department of Commerce, 1975. 21 pp.
[2] American Paper Institute, statistics of paper and paperboard, 1974.

Source: 1975 EPA "Third Report to Congress."

4. A positive sign for the future of domestic wastepaper usage is the fact that medium production and linerboard production are using increasing quantities of old corrugated as a fiber supplement.

5. A negative sign for the future of domestic wastepaper usage is a decline in using wastepaper for construction paper, board sector, and combination folding boxboard production.

B. STEEL CANS

1. Ferrous materials constitute approximately 7 percent of municipal discarded materials (excluding automobiles). About 50 percent of the ferrous fraction is steel cans.

2. It is estimated that, in 1973, approximately 5.6 million tons of cans entered the discarded materials stream. About 70 percent, 4.0 million tons, were generated in Standard Metropolitan Statistical Areas (SMSA), where recovery is more likely to be economically feasible.

3. 1973 recovery rate: Approximately 70,000 tons of cans were recycled, less than 2 percent of discards.

4. Ferrous scrap is extracted from mixed discarded materials magnetically. According to a 1974 report by American Iron and Steel Institute on discarded materials processing facilities, only 25 cities are presently separating such scrap magnetically, with at least 18 additional facilities planned.

5. The "steel" can is in reality a composite can consisting of tin-plated steel (thus, the term "tin" can) and possibly lead, organic coatings and aluminum.

a. In some cans, the percentage of non-ferrous materials is relatively high and thus damaging to the scrap iron industry. However, the non-ferrous materials may be valuable also, for example, the small quantity of tin in 3.5 million tons is worth approximately 60 million dollars, half the value of the total value of the steel cans.

6. Markets for Post-Consumer Cans:

a. There are three major potential markets for old cans: the steel industry, the detinning industry, and the copper precipitation industry. (The detinning industry is really an intermediate processor, extracting tin from the cans and selling the detinned scrap to the steel industry).

b. According to Environmental Protection Agency's "Second Report to Congress," the copper precipitation industry is the single largest user of scrap cans, accounting for 65 percent of all cans recovered in 1972. Two other industries, the steel industry and the detinning industry, have the most potential for growth in the consumption of scrap cans.

c. The Steel Industry:

i. Steel cans recovered from municipal discarded materials can be used in both the blast furnace (where ore is reduced to iron) and also the basic oxygen and electric furnaces (where iron is refined into steel).

ii. In 1972, about 34 million tons of iron and steel scrap were purchased by the industry for use in steel manufacture. The 4 million tons of post-consumer cans generated in Standard Metropolitan Statistical Areas are equivalent to about 12 percent of this amount.

iii. The American Iron and Steel Institute's Committee of Tin Mill Products Producers has estimated that 5 percent of the scrap charge to the basic oxygen (steelmaking) furnace could be scrap cans. This would be equivalent to 1.5 percent of the total steel produced or a potential demand of 3 million tons a year.

iv. The Committee has also stated that scrap cans could possibly replace about 5 percent of the iron ore in the blast furnace. Thus, the blast furnaces and basic oxygen furnaces alone could consume more scrap cans than presently exist in municipal discarded materials.

v. The lead, tin and aluminum present in can scrap can pose major barriers to the use of can scrap in steel manufacture. Undesirable contaminants can be reduced to an acceptable level by detinning. The resultant steel is a readily marketable material, "No. 1 bundle", which in 1973 commanded a price of approximately \$100–\$174 per ton.

d. The Detinning Industry:

i. Most of the 3,000 tons of tin salvaged annually from scrap cans is extracted from scrap generated in can manufacturing plants.

ii. Scrap cans for detinning should not be balled or otherwise flattened to a form that interferes with the access of the detinning solution to the tinplate surface or that does not allow easy drainage afterwards. This is an important consideration to the municipal official choosing a shredder for ferrous recovery.

iii. Incinerated cans are unacceptable because incinerators can cause the formation of oxides on the tinplate surface that are difficult to remove.

iv. The industry has indicated possible interest in building detinning plants wherever 30,000 tons of can scrap are guaranteed yearly.

v. The 1974 market value for can scrap for detinning ranged from $30 to $100 per ton, depending on quality of the material and geographical location.

vi. Traditionally, detinning has been a batch, rather than a continuous, process.

e. Copper Precipitation:

i. This is a very different form of can recycling. The steel is not actually recovered but is used in a chemical displacement reaction to precipitate copper.

ii. Copper precipitation accounted for 50,000 of the 70,000 tons of recycled cans in 1972. Old cans represented approximately 10 percent of the 500,000 tons of scrap consumed by the industry in 1972.

7. Supply of Post-Consumer Cans:

a. According to the Environmental Protection Agency "Second Report to Congress," it appears that shredding of discarded materials for ferrous material extraction alone is not economical. At $20 per ton for cans and $12 for other miscellaneous ferrous materials, revenue from ferrous material extraction would total less than $1.25 per ton of refuse processed, hardly enough to cover shredding costs in almost any size facility.

b. Refuse shredding is often justified, however, by virtue of densification for improved land fill efficiency or increased freight payloads where transfer stations are involved. In these instances, the incremental costs of ferrous material extraction should be easily covered by the revenues.

c. An excellent opportunity for ferrous material extraction is to be found in energy recovery or other types of comprehensive recovery facilities that are emerging. In all instances, shredding of discarded materials is required; and in most of the energy recovery facilities, organics must be separated from inorganics to maximize burning efficiency.

C. ALUMINUM

1. In 1973, discards of aluminum into the municipal solid discarded materials stream totaled 1.0 million tons, or 0.7 percent of the total discarded materials stream.

2. Half of the aluminum discards were cans, about one-third were foils, and the remainder was largely from major appliances.

3. About 34,000 tons of aluminum, or 3.5 percent of the amount discarded, were recovered in 1973.

4. The Aluminum Association reports that about 17 percent of the all-aluminum cans produced in 1974 were recovered.

5. Roughly 15¢ a pound is paid for aluminum cans brought to recycling collection centers.

6. About 78 percent of the aluminum cans are concentrated in five states: New York, California, Texas, Florida, and Washington.

D. GLASS

1. Glass accounts for approximately 9 percent by weight of total municipal discarded materials.

2. In 1973, over 13 million tons of glass products were discarded, and less than 3 percent, or 350,000 tons, were recovered and recycled.

3. The future of glass recovery depends in part on the expansion of voluntary collection centers and new developments either in source separation and collection of glass or in new mechanical separation techniques.

4. Demand for clean cullet exists at prices comparable to those for virgin materials.

a. Color-mixed cullet is currently valued at $20 per ton.

b. Color-sorted cullet may sell for more, depending on the market location.

i. There are at least twice as many markets for this material as for color-mixed glass.

ii. Almost all glass furnaces can utilize color-sorted glass, while only furnaces making colored glass can use color-mixed cullet.

5. Potential markets exist for color-mixed glass in construction materials, such as foamed glass insulation or bricks, but these have not yet been developed to a significant degree.

6. Glass cullet is in some ways preferable to virgin raw materials because its use reduces fuel consumption and refractory wear.

7. The glass industry generally limits the use of glass cullet in the glass formula to approximately 20 percent by weight, although 80 to 100 percent cullet formulations have been used.

E. PLASTICS

1. Plastics presently constitute approximately 3.8 percent of municipal discarded materials, but plastic consumption is growing rapidly.

2. Essentially no recovery of plastics as a material from mixed discarded materials now takes place, for they are extremely difficult to separate.

3. Plastics have the highest British thermal unit (Btu) content of any of the materials in mixed discarded materials and thus make a valuable contribution to the heat value of the discarded material. The heat content of plastics is about 11,000 British thermal units per pound, approximately the equivalent of coal.

F. TABULATION OF RECYCLING OF POSTCONSUMER DISCARDED MATERIALS, 1973

See Table II–3 at page 60 for an illustration of post-consumer residential and commercial discarded materials generation and recycle for 1973

TABLE II-3.—POSTCONSUMER RESIDENTIAL AND COMMERCIAL SOLID WASTE GENERATION AND RECYCLE: DETAILED PRODUCT-SOURCE CATEGORIES, 1973

[Thousand tons, as generated wet weight basis]

Product-source categories	Gross discards	Material recycled: Quantity	Material recycled: Percent of discards	Net waste disposal: Quantity	Net waste disposal: Percent total waste	Net waste disposal: Percent nonfood product
Durable goods	14,700	300	2	14,400	11	17
Major appliances	2,200	100	4	2,100	2	2
Furniture and furnishings	3,400	0	0	3,400	3	4
Rubber tires	2,000	200	10	1,800	1	2
Miscellaneous durables	7,100	0	0	7,100	5	8
Nondurable goods, excluding food	27,930	3,770	13	24,160	18	28
Newspapers	10,400	2,450	24	7,950	6	9
Books and magazines	3,720	330	9	3,390	3	4
Office paper	6,390	990	15	5,400	4	6
Tissue paper, including towels	2,320	0	0	2,320	2	3
Paper plates and cups	600	0	0	600	4	1
Other nonpackaging paper	1,300	0	0	1,300	1	2
Clothing and footwear	1,300	0	0	1,300	1	2
Other miscellaneous nondurables	1,900	0	0	1,900	1	2
Containers and packaging	52,270	5,330	10	46,940	35	55
Glass containers	12,400	275	2	12,125	9	14
Beer and soft drink	6,100	190	3	5,910	4	7
Wine and liquor	1,970	25	1	1,945	1	2
Food and other	4,330	60	1	4,270	3	5
Steel cans	5,650	60	1	5,590	4	7
Beer and soft drink	1,550	15	1	1,636	1	2
Food	3,140	35	1	3,105	2	4
Other nonfood	960	10	1	950	1	1
Aluminum	820	35	4	785	1	1
Beer and soft drink [1]	440	30	7	410	([2])	([2])
Other cans	50	1	2	45	([2])	([2])
Aluminum foils	330	4	1	330	([2])	([2])
Paper and paperboard	28,230	4,960	18	23,270	17	27
Corrugated	15,100	3,290	22	11,810	9	14
Other paperboard	6,925	1,045	15	5,880	4	7
Paper packaging	6,205	625	10	5,580	4	7
Plastics	3,090	0	0	3,090	2	4
Plastic containers	510	0	0	510	([2])	1
Other plastics packaging	2,580	0	0	2,580	2	3
Wood packaging	1,900	0	0	1,900	1	2
Other miscellaneous packaging	180	0	0	180	([2])	([2])
Total nonfood product waste	94,900	9,400	10	85,500	63	100
Add:						
Food waste	22,400	0	0	22,400	17	26
Yard waste	25,000	0	0	25,000	19	29
Miscellaneous inorganic wastes	1,900	0	0	1,900	1	2
Grand total	144,200	9,400	7	134,800	100	158

[1] Includes all-aluminum cans and aluminum ends for nonaluminum containers.
[2] Less than 0.5 percent.

Source: EPA update document to "Second Report to Congress, 1974" Frank A. Smith, Resource Recovery Division, Office of Solid Waste Management Programs, U.S. Environmental Protection Agency, November 1974.

G. AMOUNT OF MATERIALS POTENTIALLY RECOVERABLE

1. Table II–4 at page 61 evaluates the potential for further paper recovery. The first three product groups are primary categories for additional recovery because of their degree of concentration at the point of generation and the relative ease of separating them from other discarded materials.

TABLE II-4.—POTENTIAL FOR ADDITIONAL RECOVERY OF PAPER FROM POSTCONSUMER SOLID WASTE THROUGH SOURCE SEPARATION, BY TYPE OF PAPER, 1973[1]

(In millions of tons)

Category of wastepaper	Paper disposed of		Potential recovery	
	Total	Urban areas	Percent	Amount
Newspaper	8.0	6.2	55–65	3.4–4.0
Corrugatod	11.8	9.2	55–65	5.1–6.0
Printing/writing	9.7	7.6	30–40	2.3–3.0
Packaging and other	14.7	11.5	5–10	.6–1.2
Total	44.2	34.5		11.4–14.2

[1] The estimates in this table are based on statistics published by the American Paper Institute in their annual publication "Statistics of Paper and Paperboard, 1974." The methodology employed is described in: Smith, F. L., Jr. "A Solid Waste Estimation Procedure; Material Flows Approach." Environmental protection publication SW-147. [Washington], U.S. Environmental Protection Agency, May 1975. p. 56]

Source: 1975 EPA "Third Report to Congress."

2. Table II-5 at page 62 illustrates the recycling potentials for selected materials in post-consumer municipal discarded materials in relation to certain measures of U.S. material consumption.

a. These figures are based on the following assumptions:

i. 95 percent of the discarded materials generated is collected either through mixed discarded materials collection of specialized source-separated collection systems.

ii. 70 percent of the collected discarded materials is processed for specific material and energy values.

iii. With respect to paper, it is assumed that only 40 percent of Standard Metropolitan Statistical Area is processed for fiber recovery.

iv. With respect to the material actually processed for recycling, final material recovery efficiency is assumed to be 80 percent.

b. The national recovery ratios in Table II-5 at page — 53 percent potential recovery of minerals and the 21 percent from paper—are practical maxima from a technical standpoint. They only represent what could conceivably be achieved with current or near-future technology under a very vigorous implementation program.

c. In 1971, the percent of U.S. consumption of materials that could have been supplied from post-consumer discarded materials ranges from a low of 3 percent for lead up to as much as 18.9 percent for paper and paperboard products.

TABLE II-5.—POSTCONSUMER WASTE AND MAXIMUM MATERIAL RECYCLE POTENTIALS RELATIVE TO U.S. CONSUMPTION AND PRODUCTION FOR SELECTED MATERIALS, 1971

Item	Iron	Aluminum	Copper	Lead	Tin	Paper and paperboard
Material quantity (10^3 tons):						
Postconsumer waste*	10,600	800	250	[1] 75	[1] 28	39,100
U.S. consumption	[2] 83,500	[2] 5,074	[2] 2,823	[2] 1,431	[2] 78	[3] 58,770
U.S. primary production: Domestic raw material	[2] 54,500	[2] 377	[2] 1,411	[2] 585	----------	[3] 38,110
Total	[2] 81,400	[2] 3,925	[2] 1,592	[2] 666	----------	[3] 42,060
Percent ratio of post-consumer waste to:						
U.S. consumption	12.7	15.8	8.9	5.2	35.8	66.5
U.S. primary production: Domestic raw material	19.4	212.2	17.7	12.8	----------	102.6
total	13.0	20.4	15.7	11.3	----------	93.0
Estimated maximum recovery potential: As percent of waste material	53	53	53	53	53	21
Total recovered (10^3 tons)	5,618	400	133	40	15	8,200
Percent ratio of potential recovery to—						
U.S. consumption	6.7	8.4	4.7	2.8	18.9	14.0
U.S. primary production: Domestic raw material	10.3	112.5	9.4	6.8	----------	21.5
Total	6.9	10.8	8.3	6.0	----------	19.5

*Based on EPA calculations.
[1] Tin can fraction only.
[2] U.S. Bureau of Mines. 1971 Minerals yearbook. Washington, U.S. Government Printing Office, 1972.
[3] The statistics of paper. Washington, American Paper Institute, 1972.

Source: 1974 EPA "Second Report to Congress".

d. The potential reductions in primary production from virgin domestic resources could have amounted to:

10.3 percent for iron
9.4 percent for copper
6.8 percent for lead
21.5 percent for paper
100 percent for aluminum
100 percent for tin

e. Conclusions:

i. Recycling post-consumer discarded materials is not a panacea in the sense that it cannot be expected to supply the majority of the nation's raw material demands.

ii. The substitution possibilities, both with regard to total consumption and domestic virgin material supply, are not insignificant.

iii. In addition to direct material resource savings, there will also accrue further net indirect savings in the form of reduced capital equipment and other material input requirements in the mining, ore reduction and beneficiation, and smelting sectors of the virgin mineral industries, as well as similar reductions in the tree harvesting, wood preparation, and wood pulping segments of the pulp and paper industry. There will be, of course, some offsetting new capital goods requirements for processing the discarded materials, but these generally appear to be substantially less than those for virgin material. No quantitative evaluation on this issue has yet been made.

3. Table II–6 at page 63 illustrates an estimate of practical maximum impact of an assumed possible recycling increase on annual municipal discarded materials disposal and virgin material demand.

TABLE II-6.—ESTIMATE OF PRACTICAL MAXIMUM IMPACT OF INCREASED MATERIAL RECYCLING ON ANNUAL MUNICIPAL WASTE DISPOSAL AND VIRGIN MATERIAL DEMAND

Type of material	Weight (dry) in municipal waste, 1968 (10⁶ tons)	Percent by wet weight of total municipal waste, 1968	Annual U.S. consumption of virgin material (10⁶ tons)	Assumed possible recycling increase: Percent of material in waste	Assumed possible recycling increase: Weight (10⁶ tons)	Reduction in total municipal waste disposal as a result of increased recycling (percent): Dry	Reduction in total municipal waste disposal as a result of increased recycling (percent): Wet	Reduction in virgin material demand as a result of increased recycling (percent)
Paper and board	40	40.0	44	15	6.0	6.0	6.0	13.6
Metal	12	8.0	93	20	2.4	2.4	1.6	2.6
Rubber tires	2	1.3	3	80	1.6	1.6	1.1	53.3
Glass	12	8.0	12	50	6.0	6.0	4.0	50.0
All other	34	44.0	----------	0	0	0	0	0
Total								
Dry	100	----------	152	----------	16.0	16.0	----------	----------
Wet	150	100.0	----------	----------	----------	----------	12.7	----------

Source: 1974 EPA "Second Report to Congress."

III. Energy Recovery

A. FOUR OPPORTUNITIES TO CONSERVE ENERGY THROUGH BETTER DISCARDED MATERIALS MANAGEMENT

1. *Source reduction.*—reducing consumption of products or reusing products, resulting in the use of less energy and materials and in the reduction in discarded materials generation.

2. *Energy recovery.*—using discarded materials as a fuel in place of coal, oil or gas.

3. *Recycling.*—using recycled materials that consume less energy than virgin materials in manufacturing processes.

4. *Improved collection.*—using waste collection trucks more efficiently, reducing fuel consumption.

B. TABLE III–1 BELOW IS AN ILLUSTRATION OF THE MAXIMUM POSSIBLE ENERGY SAVINGS FROM SOURCE REDUCTION, ENERGY RECOVERY, RECYCLING, AND IMPROVED COLLECTION. IT SHOULD BE BORNE IN MIND IN THE CONSIDERATION OF TABLE III–1 THAT THE ENERGY SAVED IN ONE AREA MAY REDUCE THE POTENTIAL FOR SAVINGS IN ANOTHER (E.G., RECYCLING COMBUSTIBLE MATERIALS LIKE PAPER WILL REDUCE THE AMOUNT OF DISCARDED MATERIALS AVAILABLE FOR ENERGY RECOVERY).

TABLE III–1.—MAXIMUM POSSIBLE ENERGY SAVINGS FROM SOURCE REDUCTION, ENERGY RECOVERY, RECYCLING AND IMPROVED COLLECTION

	B/DOE [1] (thousand)	B/YOE [2] (million)	Btu's [3] (trillion)
Source reduction	115	42	244
Energy recovery	393	143	832
Recycling	80	30	172
Improved collection	3	1	6

[1] Barrels per day of oil equivalent.
[2] Barrels per year of oil equivalent.
[3] British thermal units. 1 trillion = 1×10^{12}.

Source: Energy Conservation Through Improved Solid Waste Management, EPA, 1974.

C. ENERGY CONSERVATION MEASURES DISCUSSED SUPRA COULD BE COMBINED IN A VARIETY OF WAYS. FOR EXAMPLE, ENERGY RECOVERY CAN IMPROVE THE ECONOMICS OF MATERIALS RECYCLING. IN AN ENERGY RECOVERY SYSTEM, THE NONCUMBUSTIBLE RECYCLABLE MATERIALS ARE TYPICALLY SEPARATED FROM THE MIXED DISCARDED MATERIALS (AND THEREFORE AVAILABLE FOR RECYCLING) EVEN IF THEY ARE NOT GOING TO BE RECYCLED. THE ADDITIONAL COST OF REMOVING THE RECYCLABLE MATERIALS APPEARS TO BE LESS THAN THE ADDITIONAL REVENUES FROM THE SALE OF THOSE MATERIALS.

1. Table III–2 below presents the "maximum feasible" energy conservation benefits from three sample scenarios.

2. The potential benefits, 521,000 barrels per day of oil equivalent (B/DOE) of Scenario 3 of Table III–2, is equal to:

a. Seven percent of all the fuel consumed by utilities in 1970 (7.1 million barrels per day of oil equivalent).

b. 14 percent of all the coal consumed by utilities in 1970 (3.7 million barrels per day of oil equivalent).

c. 35 percent of the oil projected to be delivered through the Alaskan Pipe Line (1.5 million barrels of oil per day equivalent).

d. 52 percent of the crude oil imported directly from the Middle East in September 1973 (1.0 million barrels of oil per day equivalent).

e. 1.5 percent of all energy consumed in the U.S. in 1970 (32.5 million barrels of oil per day equivalent).

TABLE III–2.—COMBINED ENERGY SAVINGS FROM 3 "MAXIMUM POSSIBLE" ENERGY CONSERVATION SCENARIOS FOR 1972

[Thousand barrels per day of oil equivalent]

	Scenario 1—Energy recovery recycling and improved collection	Scenario 2—Energy recovery recycling, improved collection and source separation	Scenario 3—Energy recovery paper and materials recycling, improved collection and source reduction
Energy recovery	393	[1]357	[1]357
Recycling[2]	80	80	46
Improved collection	3	3	3
Source separation[3]		NA	NA
Source reduction[4]			115
Total	476	440	521

[1] Energy content of wastes reduced 9 percent by source separation. See note 3.
[2] Recycling of noncombustible materials: aluminum, glass and steel.
[3] Source separation and recycling of newsprint, corrugated and mixed office waste papers at a recovery rate of 35 percent of the paper in the waste stream.
[4] Source reduction refers to the beverage container example described above: it assumes that all consumers usod refillable bottles and that each bottle made 10 trips.

Not available—Data on the energy savings from recycling paper are not available for 3 reasons: (a) Independently developed estimates on the energy effects of paper recycling differ materially in certain significant quantitative details. (b) The more energy intensive virgin pulping operation typically derive at least part of their energy requirements from bark and other wood wastes rather than from fossil fuel sources. (c) A satisfactory definition of the "maximum possible" paper recycling scenario has not been developed, mainly because there are a great many variables on both the supply and of the waste paper utilization picture.

Source: "Energy Conservation through Improved Solid Waste Management," EPA, 1974.

D. BENEFITS OF ENERGY RECOVERY FROM DISCARDED MATERIALS

1. Use of discarded materials as an energy source provides the following benefits: *a.* Replacement of the use of fossil fuels; *b.* Production of low sulfur oxide emissions because discarded materials has a low sulfur content; *c.* Reduction of the amount of land needed for disposal sites; *d.* Ready availability, increasing rather than depleting the domestic source of energy.

E. ENERGY CONSERVATION THROUGH SOURCE REDUCTION

1. Four general approaches: *a.* Product reuse (e.g., returnable bottles); *b.* reduce resource intensiveness (e.g., smaller autos); *c.* increased product lifetime (e.g., longer lasting household appliances); *d.* decreased product consumption (e.g., reduced packaging consumption).

2. The following tables are from the 1974 Environmental Protection Agency's Report on "Energy Conservation through Improved Solid Waste Management."

a. Table III–3 below is an illustration of the energy potentially recoverable from wastes, for 1971, based on a Mitre Report, 1975.

TABLE III-3.—ENERGY POTENTIALLY RECOVERABLE FROM WASTES, 1971 SUMMARY

Waste type	Total quantity generated (10^6 tons)	Quantity available (10^6 tons)	Available Btu's (trillions)	Barrels per year oil equivalent (million barrels)
Municipal discarded materials	125	92.6	926	160.0
Sewage sludge	12	1.5	21	3.6
Industrial	44	5.2	68	12.0
Agricultural:				
Manures	200	26.0	338	58.0
Crops	390	23.0	313	54.0
Forestry	55	5.0	60	10.0

Source: Mitre Report, July 1975: "Energy Conservation Waste Utilization Research and Development Plan Under Contract ERDA."

b. Table III–4 below is an illustration of the energy potentially recoverable from wastes for 1980, based on a Mitre Report, 1975.

TABLE III-4.—ENERGY POTENTIALLY RECOVERABLE FROM WASTES, 1980 SUMMARY

Waste type	Total quantity generated (10^6 tons)	Quantity available (10^6 tons)	Available Btu's (trillions)	Barrels per year oil equivalent (million barrels)
Municipal discarded materials	160	121.0	1,210	209.0
Sewage sludge	14	1.8	25	4.3
Industrial	50	6.0	78	13.0
Agricultural:				
Manures	266	35.0	455	78.0
Crops	390	23.0	313	54.0
Forestry	59	5.4	65	11.0

Source: Mitre Report, July 1975: "Energy Conservation Waste Utilization Research and Development Plan Under Contract ERDA".

c. Table III–5 at page 66 is an illustration of the energy savings of source reduction program for reusable beer and soft drink containers for 1972.

TABLE III-5.—ENERGY SAVINGS OF SOURCE REDUCTION PROGRAM—REUSABLE BEER AND SOFT DRINK CONTAINERS (1972)

Container type	Beverage delivered (million ounces [1])		Energy required per million ounces (million Btu's) [2]	Energy consumed (trillion Btu's)		Energy saving of all returnable system (trillion Btu's)
	Present system	All returnable system		Present system	All returnable system	
Returnable glass bottle	293, 554	1, 007, 654	184	54	186	(132)
1-way glass bottle	260, 989		550	144		144
Aluminum can	104, 336		747	78		78
Bi-metal (steel) can	348, 775		443	154		154
Total	1, 007, 654	1, 007, 654		430	186	244

[1] Midwest Research Institute, Draft Report, Base Line Forecasts of Resource Recovery.
[2] Midwest Research Institute, Draft Report, Profile Analysis of 9 Beverage Container Alternatives.
Source: 1974 EPA Report on Energy Conservation through Improved Solid Waste Management.

d. Table III–6 below is an illustration of energy savings of source reduction program for reusable beer and soft drink containers for 1980.

TABLE III-6.—ENERGY SAVINGS OF SOURCE REDUCTION PROGRAM—REUSABLE BEER AND SOFT DRINK CONTAINERS (1980)

Container type	Beverage delivered (million ounces [1])		Energy required per million ounces (million Btu's) [2]	Energy consumed (trillion Btu's)		Energy of all returnable system (trillion Btu's)
	Projected system	All returnable system		Projected system	All returnable system	
Returnable glass bottle	295, 673	1, 406, 980	184	54	259	(205)
1-way glass bottle	385, 253		550	212		212
Aluminum can	301, 998		747	226		226
Bi-metal (steel) can	424, 056		443	188		188
Total	1, 406, 980	1, 406, 890		680	259	421

[1] Midwest Research Institute, Draft Report, Base Line Forecasts of Resource Recovery.
[2] Midwest Research Institute, Draft Report, Profile Analysis of 9 Beverage Container Alternatives.
Source: 1974 EPA Report on Energy Conservation through Improved Solid Waste Management.

e. Table III–7 below is an illustration of the energy savings of source reduction programs, decreased packaging materials (excluding beverage containers, 1971 and 1980).

TABLE III-7.—ENERGY SAVINGS OF SOURCE REDUCTION PROGRAM—DECREASED PACKAGING MATERIALS (EXCLUDING BEVERAGE CONTAINERS) (1971 AND 1980)

Packaging material	Total consumption (thousand tons) [1]			Consumption at 1958 per capita levels (thousand tons) [2]		Potential material savings (thousand tons)		Energy requirement per ton (thousand Btu's) [3]	Potential energy savings (trillion Btu's)	
	1958	1971	1980	1971	1980	1971	1980		1971	1980
Paper	16, 552	27, 700	39, 086	21, 137	25, 043	6, 563	14, 043	[4] 40, 800	267.8	573.0
Glass	5, 063	4, 900	6, 608	6, 465	7, 660	(1, 565)	(1, 052)	15, 256	(23.9)	(16.0)
Steel	5, 340	5, 235	6, 168	6, 819	8, 079	(1, 584)	(1, 911)	29, 590	(46.8)	(56.5)
Aluminum	97	212	507	124	147	88	360	196, 632	17.3	70.8
Plastics	368	2, 900	5, 607	470	557	2, 430	5, 050	36, 000	87.5	181.8
Total	27, 420	40, 947	57, 976	35, 015	41, 486	5, 932	16, 490		322.5	753.1

[1] Office of Solid Waste Management Programs. 2d report to Congress; resource recovery and source reduction. Environmental Protection Agency, Publication SW–122. Washington, U.S. Government Printing Office, 1974. 112 p.
[2] Assumes a return to an equivalent 1958 packaging materials mix (i.e., the percentage of each material used in packaging is assumed to be constant). Economic growth, and increased standards of living, is allowed for by increasing total packaging required by a growth factor (the rate of increase in nondurable goods purchased).
[3] Gordian Associates, Energy Consumption for 6 Basic Materials Industries, EPA Draft Report.
[4] Approximately 40 percent of this energy value is derived from the Btu's contained in the raw material (wood), not from purchased fuels.
Source: 1974 EPA Report on Energy Conservation through Improved Solid Waste Management.

f. III–8 below is an illustration of the energy savings of source reduction programs, decreased packaging consumption.

TABLE III–8.—ENERGY SAVINGS OF SOURCE REDUCTION PROGRAM—DECREASED PACKAGING CONSUMPTION

Year	(A) Energy saved from beverage container reusable system		(B) Energy saved from roduction in all other packaging materials		(A) + (B) Total energy saved all packaging materials	
	Trillion Btu's	B/DOE [1] (thousands)	Trillion Btu's	B/DOE [1] (thousands)	Trillion Btu's	B/DOE [1] (thousands)
1971	244	115	322	152	566	267
1980	421	199	753	356	1,174	555

[1] Barrels of oil per day equivalent.

Source: 1974 EPA Report on Energy Conservation through Improved Solid Waste Management.

F. ENERGY RECOVERY FROM DISCARDED MATERIALS

1. Table III–9 below is an illustration of the energy potentially recoverable in theory from residential and commercial discarded materials, according to the 1975 Environmental Protection Agency's "Third Report to Congress."

TABLE III–9.—ENERGY POTENTIALLY RECOVERABLE FROM RESIDENTIAL AND COMMERCIAL SOLID WASTE [1]

	1973			1980		
	Btu [2] (trillion)	B/DOE [3] (thousand)	B/YOE [4] (million)	Btu (trillion)	B/DOE (thousand)	B/YOE (million)
Theoretical	1,194	564	206	1,440	680	248
Available [5]	899	424	154	1,085	512	187
Projected recovery				85	40	15

[1] These estimates are a function of (1) population; (2) the average amount of residential and commercial solid waste generated per person, and (3) the energy content of the waste (4,500 Btu per pound). The heating value of 4,500 Btu per pound (9,000,000 Btu per ton) is generally accepted for "as received," unprocessed waste as delivered by a collection truck to a processing or disposal facility.

[2] Btu: British thermal unit.

[3] B/DOE: Barrels per day of oil equivalent. (Assuming 5,800,000 Btu per barrel of oil and 365 days per year.)

[4] B/YOE: Barrels per year of oil equivalent.

[5] Based on all Standard Metropolitan Statistical Areas (SMSA's).

Note: Different waste processing methods have different recovery efficiencies. For example, a shredding/air classification waste processing system loses some potential energy by removing heavy combustibles from the fuel fraction, while high-temperature incineration with no prior classification would lose far less potential energy. However, no adjustment was made to allow for such processing losses or energy conversion efficiencies (of, say, steam or electricity) because no prejudgment can be made as to which energy recovery method would be used in any given situation.

Source: 1975 EPA "Third Report to Congress."

2. Not all discarded materials are available for energy recovery. Energy recovery systems require large quantities of discarded materials (at least 200 to 250 tons per day) delivered for processing at one site in order to achieve economies of scale. For this reason, energy recovery appears feasible only in more densely populated areas, such as most Standard Metropolitan Statistical Areas.

a. If energy recovery had been practiced in all Standard Metropolitan Statistical Areas in 1973, almost 900 trillion British thermal units would have been recovered. This is equal to more than 424,000 barrels per day of oil equivalent (B/DOE) or 154 million barrels per year of oil equivalent (B/YOE).

b. By 1980, the energy potentially recoverable from the Standard Metropolitan Statistical Area discarded materials stream is projected to be about 1,085 trillion British thermal units per year, the equivalent of more than 512,000 barrels per day of oil equivalent, or 187 million barrels per year of oil equivalent.

c. The potential for installation of energy recovery plants is limited by the population size required to support plants of economical scale. Though smaller plants are feasible, Environmental Protection Agency's "Second Report to Congress" estimates a 500 ton-per-day plant to be a reasonable plant scale. Table III–10 below is an illustration of the potential for such recovery plant installations.

TABLE III–10.—POTENTIAL FOR RESOURCE RECOVERY PLANT INSTALLATION[1]

Item	1970	1975	1980	1985
Population of the United States[2]	[3] 208,212,000	216,553,000	232,966,000	251,271,000
SMSA's with sufficient population to generate 500 tons/day of refuse:[4]				
Number	125	148	169	192
Percent of population living in these SMAS's	62	63	64	66
Cities with sufficient population to generate 500 tons/day of refuse:[5]				
Number	56	61	80	99
Percent of population living in these cities	20	21	23	24

[1] Source: EPA estimates based on data in U.S. Bureau of the Census. 1970 Census of Population. 2 v. Washington, U.S. Government Printing Office, 1972.

[2] Based on a growth rate of 1.25 percent per year.

[3] U.S. Department of Commerce Bureau of the Census' Series E population projections.

[4] An annual increase in per capita waste generation of 3 percent per year was assumed, beginning with 4 pounds per person per day in 1970. Population increase is assumed to be 1½ percent per year.

[5] An annual increase in per capita waste generation of 3 percent per year was assumed, beginning with 4 pounds per person per day in 1970. Population increase is assumed to be 1 percent per year.

Source: 1974 EPA "Second Report to Congress."

3. Technological developments that have been underway over the past few years are greatly expanding opportunities for energy recovery from mixed discarded materials. These major systems are:

a. Shredded discarded materials as a fuel. In this system refuse is shredded and separated into basic light and heavy fractions. The light fraction can then be used as a fuel substitute in utility and industrial furnaces.

b. Pulped discarded materials as a fuel. This entails wet pulping of refuse followed by a basic separation of organic and inorganic fractions. The entire organic fraction can then be burned or a portion of it can be recovered as fiber.

c. Pyrolysis to produce oil or gas. Pyrolysis is chemical decomposition of discarded materials in a high temperature and low oxygen atmosphere. Proper control of the operating conditions and further processing of the products of decomposition produce either oils (roughly equivalent to No. 6 fuel oil) or gases that can be used as fuel substances. Processing of the discarded materials to remove inorganics generally occurs prior to pyrolysis.

d. Pyrolysis for steam generation. In this process discarded materials is pyrolyzed, and the pyrolysis gases are burned in an afterburner and used to generate steam. Prior separation of the discarded materials is not required. This option has the same steam marketing problems associated with heat recovering incinerators.

e. Incineration with electricity generation. This system involves use of gases from high-pressure incineration to drive a gas turbine electric generator.

4. Comparison of energy forms:

a. Steam and electricity are salable and usable without significant inconvenience to the user, but neither are storable and steam can be transported only short distances.

b. Solid and liquid fuels derived from discarded materials can be transported and temporarily stored but they required the user to install special storing and fir ing facilities.

c. Gaseous fuels derived from discarded materials require less special handling but those currently produced cannot economically be compressed for extended storage and shipment (best shipment rate: 2 miles).

5. Table III–11 below is an illustration of the energy efficiency values of discarded materials to energy projecrs (for illustration of the projected implementations of energy recovery systems by 1980, see Table IV–1, at page 72).

TABLE III–11.—ENERGY EFFICIENCY VALUES, WASTE TO ENERGY PROJECTS

Project:	Percentage of energy efficiency
Braintree, Mass	39
Chicago, Ill. (northwest incinerator)	([1])
Harrisburg, Pa. (incinerator)	([1])
Nashville, Tenn	([1])
Saugus, Mass	([1])
St. Louis EPA demonstration	70
Baltimore EPA demonstration	51
Union Purox Test Facility	67
San Diego EPA demonstration	39
Carborundum Torrax Facility	([1])

[1] Data not available.

Source: EPA statistics submitted upon Subcommittee request, 1976

G. ENERGY CONSERVATION THROUGH RECYCLING

1. A production system using recycled or secondary materials most often consumes less energy than a system using virgin materials, when all stages of materials acquisition, processing and transportation are included.

2. Table III–12 below is an illustration of the national energy savings from maximum possible recycling of aluminum, ferrous and glass fractions of post-consumer discarded materials.

TABLE III–12.—NATIONAL ENERGY SAVINGS FROM MAXIMUM POSSIBLE RECYLCING OF ALUMINUM, FERROUS, AND GLASS FRACTIONS OF POSTCONSUMER SOLID WASTE

[In trillions of Btu's][1]

Materials[2]	1972	1975	1980	1985	1990
Aluminum [46 percent to 56 percent]	82	115	164	212	274
Ferrous [63 percent to 67 percent]	81	87	95	107	116
Glass [50 percent to 52 percent]	8	13	15	16	16
Total energy	172	215	274	335	406

[1] Energy savings are based on "total system" analyses which include primary energy required for raw material acquisition and electricity input as well as for principal refining processes.

[2] Figures in brackets indicate percentages of the individual material in nation-wide solid waste assumed to be recoverable from a "maximum possible" recovery effort. Lower percentages are for earlier years, higher percentages for later years when larger proportions of population is expected to reside in SMSA's and when extraction efficiency expected to rise. Recovery quantities based on residential and commercial solid waste only.

Source: "1974 EPA Report on Energy Conservation Through Improved Solid Waste Management."

H. ENERGY CONSERVATION THROUGH IMPROVED COLLECTION

1. According to the 1974 Environmental Protection Agency report "Energy Conservation through Improved Solid Waste Management", 287 million gallons of gasoline and 362 million gallons of diesel fuel are used annually for discarded materials collection and land disposal.

2. Various measures for energy conservation:

a. collection once instead of twice a week could save 29 percent of "collection fuel." On a national basis, 18.2 million gallons of diesel fuel and 39.1 million gallons of gasoline would have been saved between 1972 and 1973 had collection been changed from twice a week to once a week. This is equivalent to 3,000 barrels per day of oil.

b. collection of all discarded materials at one time could save fuel, though the fuel cost for separate collection of newspaper and other materials for resource recovery is outweighed by the energy saved in the recycling process.

c. improved routing could save 5 percent on "collection fuel."

IV. MATERIALS AND ENERGY RECOVERY PROJECTS

A. SYSTEMS CONSTRUCTED OR OPERATING (THIS LISTING DOES NOT INCLUDE LOCATIONS WHERE ONLY ONE MATERIAL IS RECOVERED.) ENVIRONMENTAL PROTECTION AGENCY-FUNDED DEMONSTRATION PROJECTS ARE MARKED:**

1. *St. Louis, Missouri***—A 300 ton per day (TPD) capacity plant that converts municipal discarded materials into a shredded refuse derived fuel (RDF) for supplemental firing in Union Electric Co. utility boilers. Ferrous metals are also recovered.

2. *Franklin, Ohio***—A 150 ton per day capacity plant that uses a wet pulping process to pulverize and classify discarded materials for recovery of paper fiber. Ferrous metals, glass and aluminum are recovered in a sub-system.

3. *Baltimore, Maryland* **—A 1,000 ton per day plant that takes municipal discarded materials, pyrolyzes (destructive distillation in a low oxygen atmosphere) it into a low British thermal unit gas and burns the gas on site to produce steam for use in a downtown steam loop. Ferrous metals and a glassy aggregate are also recovered.

4. *Somerville, Massachusetts***—Municipal discarded materials are separated into three segments in the home: (1) paper, (2) clear glass and cans and (3) non-recyclable discarded materials. Non-recyclables are collected in a regular packer truck. All recyclables are collected weekly in a specially built compartmentalized vehicle from the curb.

5. *Marblehead, Massachusetts***—Municipal discarded materials are segmented into four categories in the home: (1) paper, (2) clear glass and cans, (3) brown and green glass and cans, and (4) non-recyclable discarded materials. Curbside collections are carried out in the same manner as in Somerville.

6. *Ames, Iowa*— A 200 ton per day plant that converts municipal discarded materials waste into refuse derived fuel. The refuse derived fuel is used for supplemental fuel in the City's utility boilers. Ferrous metals and aluminum are also recovered.

7. *Saugus, Massachusetts*—A 1,200 ton per day plant that uses unprocessed municipal discarded materials as a primary fuel for a steam

generator. This type operation is normally referred to as a waterwall incinerator. The steam is used by an industrial manufacturer located a short distance from the plant. Ferrous metal is also recovered.

8. *Nashville, Tennessee*—A 760 ton per day waterwall incinerator that generates steam used in a downtown loop. The steam is also used to produce chilled water for cooling the downtown buildings.

9. *South Charleston, West Virginia*—The Union Carbide Company has a 200 ton per day test facility that takes municipal discarded materials and pyrolyzes it into a medium British thermal unit gas that is suitable as a boiler fuel.

10. *Braintree, Massachusetts*—A 240 ton per day waterwall incinerator. The steam is now used by a manufacturing plant.

11. *San Francisco, California*—Gas recovery from an existing landfill. Methane gas is collected from the old landfill and used to generate electricity.

12. *Los Angeles, California*—Another methane recovery project similar to San Francisco.

B. SYSTEMS UNDER CONSTRUCTION

1. *San Diego, California***—A 200 ton per day plant that converts municipal discarded materials into an oil like liquid fuel by pyrolysis. The liquid fuel produced will be used as a supplementary fuel by San Diego Gas and Electric Company. Ferrous, glass and aluminum will also be recovered.

2. *Chicago, Illinois*—A 1,000 ton per day second generation St. Louis type facility.

3. *Milwaukee, Wisconsin*—A 1,200 ton per day second generation St. Louis type facility. Ferrous metal, aluminum, paper and a glassy aggregate will also be recovered.

4. *New Orleans, Louisiana*—A 650 ton per day plant that will recover glass, ferrous metals, non-ferrous metals and paper. The remaining fraction, approximately 80% by weight of the incoming discarded materials will be disposed of on the land.

5. *East Bridgewater, Massachusetts*—A 600 ton per day incinerator with a separate processing line for converting a portion of municipal discarded materials into a dust like fuel supplement. This plant will produce Eco-Fuel II for use in an industrial boiler and for testing in other boilers.

6. *Wilmington, Delaware*—A 500 ton per day project to prepare municipal discarded materials as a supplementary fuel to be used in an oil fired utility boiler.

C. PROJECTION OF IMPLEMENTATIONS OF ENERGY RECOVERY SYSTEMS BY 1980.

1. See Table IV–1 at page 72 for an illustration of the projected implementations of energy recovery systems by 1980.

TABLE IV-1.—PROJECTED IMPLEMENTATIONS OF ENERGY RECOVERY SYSTEMS BY 1980

Location and tons per day	*Description*
California: San Diego County—200.	Pyrolysis; U.S. EPA is sponsoring project to demonstrate the Garrett Research and Development system; oil produced will be accepted by San Diego Gas and Electric; project in engineering design phase.
Connecticut: Bridgeport—1,200.	Solid waste as fuel; State-wide resource recovery authority is reviewing proposals; Northeast Utilities will accept the fuel.
District of Columbia—1,000	Solid waste as fuel; District of Columbia, Fairfax County, Arlington County, the city of Alexandria, and the Council of Governments are studying the feasibility of implementing a supplemental fuel system on a region-wide basis; Virginia Electric Power Co. and Potomac Electric Power Co. are cooperating in the studies.
Illinois:	
Chicago—2,000	Solid waste as fuel; construction started in early March; Commonwealth Edison will accept the fuel.
Chicago area excluding the City—1,000.	Solid waste as fuel; several suburbs have approached Commonwealth Edison to determine the feasibility of implementing supplemental fuel systems.
Iowa: Ames—200	Solid waste as fuel; construction to begin by June, 1974; municipal electric utility will accept the fuel.
Maryland:	
Baltimore—1,000	Pyrolysis; U.S. EPA is sponsoring project to demonstrate the Monsanto system; pyrolysis gas will be combusted on-site to generate steam for sale to Baltimore Gas and Electric; plant will be operational in early 1975.
Montgomery County 1,200.	Solid waste as fuel; County is planning project with Potomac Electric Power Co. cooperation; feasibility study has been completed; County Council and County Executive have approved the plan.
Massachusetts:	
Braintree—240	Water wall incineration; plant has been operating since 1972; Contract signed early 1974 for sale of steam to Weymouth Art Leather, Co.
East Bridgewater (near Brockton)—1,200.	Solid waste as fuel; Combustion Equipment Associates and others; privately financed processing facility; Weyerhauser is accepting the fuel for their industrial steam boilers.
Saugus (near Boston)—1,200.	Water wall incineration; plant under construction; steam product will be sold to General Electric Co. for process steam.
Lawrence—1,000	Solid waste as fuel; Lawrence will be the first implementation under the State-wide solid waste master plan approved in early 1974; master plan calls for supplemental fuel production for steam and steam-electric boilers, and materials recovery.
Missouri: St. Louis—8,000	Solid waste as fuel; Union Electric Co. plans to implement, by mid-1977, a system to handle the residential, commercial and selected industrial waste from the entire metropolitan area; U.E. will process raw waste, recover magnetic metal, aluminum, and glass as well fuel for their boilers.

TABLE IV-1.—PROJECTED IMPLEMENTATIONS OF ENERGY RECOVERY SYSTEMS BY 1980—Continued

Location and tons per day	*Description*
New Jersey:	
Essex County (Newark area)—1,000	Solid waste as fuel; Request For Proposals is being prepared; supplemental fuel to be accepted by Public Services Gas and Electric or other industrial steam boilers.
Hackensack Meadowlands—2,000.	Solid waste as fuel; detailed proposals are currently being reviewed; it is anticipated that the fuel will be accepted by Public Services Gas and Electric or industrial steam boilers.
Union County (Elizabeth), or Middlesex County (New Brunswick)—1,000.	Solid waste as fuel; feasibility of producing a supplemental fuel for Public Services Gas and Electric is being assessed.
New York:	
Albany area—500	Solid waste as fuel; feasibility of producing supplemental fuel for industrial steam boilers, state-owned heating plant, and municipal electric utility is being assessed.
Hempstead—1,000	Detailed proposals have been received for design and construction of energy and materials recovery systems.
Monroe County (Rochester)—500	Solid waste as fuel; feasibility study to produce a supplemental fuel for Rochester Gas and Electric completed; Request For Proposals being prepared.
New York City—2,000	Solid waste as fuel; City has completed feasibility study of using City waste as supplemental fuel in Commonwealth Edison's boilers; City writing Request For Proposals to design and construct supplemental fuel facility; City and Commonwealth Edision also plan to initiate contract in Spring 1974 to determine feasibility of designing new steam-electric boiler to burn 50 percent solid waste.
Westchester County (White Plains)—1,500.	Feasibility study for solid waste disposal completed; County most interested in energy recovery for County-owned industrial park.
Ohio:	
Akron—1,000	Water wall incineration; detailed engineering study is underway; steam product will be used for downtown heat and air conditioning and for B.F. Goodrich process steam.
Cleveland—500	City has requested and received bids for a steam generation system; the super-heated steam product will be used for electric generation by the municipal utility.
Oregon: Lane County (Eugene)—700.	Solid waste as fuel; feasibility study completed to use waste as supplemental fuel in a Eugene municipal steam power plant that currently burns wood waste; additional waste fuel is required because wood wastes are becoming scarce.
Pennsylvania: Philadelphia—2,400.	Solid waste as fuel; Combustion Equipment Associates has announced plans to construct and operate, with private financing, a facility to produce supplemental fuel for industrial steam boilers.
Puerto Rico: San Juan—1,000	San Juan planning to initiate feasibility study for a solid waste as fuel system; supplemental fuel would be used by Commonwealth-owned San Juan steam-electric station.

TABLE IV-1.—PROJECTED IMPLEMENTATIONS OF ENERGY RECOVERY SYSTEMS BY 1980—Continued

Location and tons per day	*Description*
Tennessee:	
Knoxville—500	Pyrolysis; Tennessee Valley Authority is studying the feasibility of implementing a Torrax gas pyrolysis system to produce gas as supplemental fuel for an adjacent TVA steam-electric boiler.
Memphis—500	Solid waste as fuel; detailed proposals have been requested to implement a wet processing system to produce supplemental fuel for a Tennessee Valley Authority steam-electric boiler.
Nashville—750	Water wall incineration; construction is complete; public authority has been formed to construct and operate the facility; steam product will be used for downtown heating and air conditioning.

Source: "Energy Conservation Through Improved Solid Waste Management," EPA, 1974.

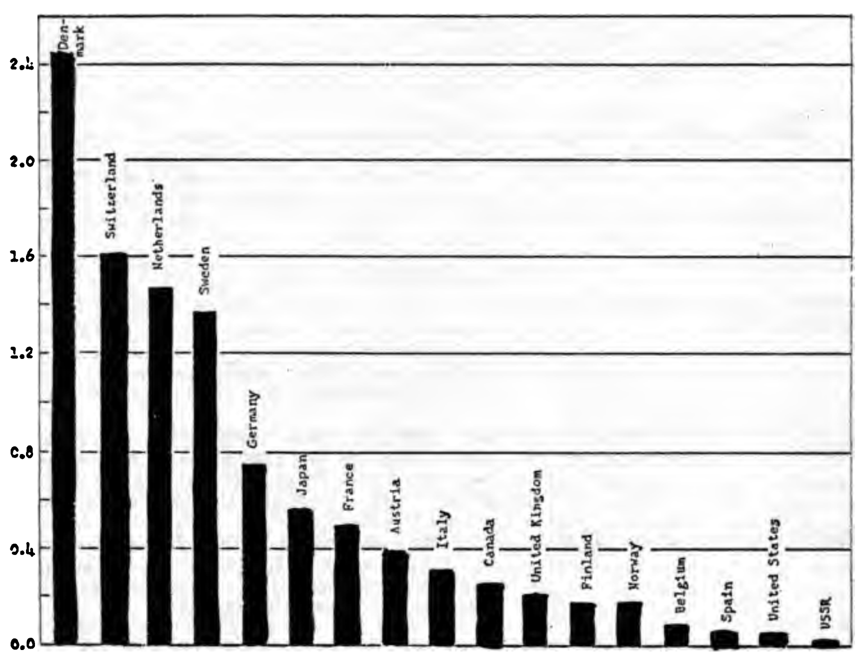
D. POUNDS OF PROCESSED WASTE PER CAPITA IN SELECTED COUNTRIES

1. See Table IV-2 below for an illustration of pounds of waste processed in refuse fired steam generators to steam, per capita per day in selected countries.

TABLE IV-2.—POUNDS OF WASTE PER PERSON PER DAY

SELECTED COUNTRIES

Pounds of waste processed in refuse fired steam (steam or hot water) generators to steam per capita per day in selected countries (rated installed capacity). There are 300 distributing heatlng systems in Denmark and 103 in the United States. (Battelle Study, January 1976)



E. TONNAGE CAPACITY FOR REFUSE-FIRED STEAM GENERATORS IN SELECTED COUNTRIES

1. See Table IV-3 for an illustration of the capacity tonnage of refuse-fired steam generators installed or under construction in selected countries.

TABLE IV-3.—CAPACITY TONNAGE OF REFUSE FIRED STEAM GENERATORS INSTALLED OR UNDER CONSTRUCTION

	Tonnes/Day	Number of units where tonnes are known	Tonnes per day per unit	Total number of refuse fired steam generators
Austria	1,320	2	660	
Belgium	400	1	400	
Canada	2,800	3	933	
Denmark	5,670	36	158	
Finland	384	1	384	
France	11,708	28	418	
Germany	26,908	31	868	[1] 43
Netherlands	8,892	8	1,111	
Italy	7,747	22	352	[1] 24
Japan	27,198	43	633	[1] 49
Norway	312	1	312	
U.S.S.R.	400	1	400	
Spain	960	2	480	
Sweden	5,090	21	242	[1] 23
Switzerland	5,170	21	246	
United Kingdom	5,921	9	658	[1] 10
United States	5,140	6	857	[1] 10
Total	116,020	236	492	[1] 257

[1] Reflects that units are known but tonne capacity is not known by us at this time. Battelle study estimates 95 percent of the above generators are waterfall generators.

V. FEDERAL ACTION

A. THE SOLID WASTE DISPOSAL ACT OF 1965

The initial Solid Waste Disposal Act of 1965 emphasized the health impacts of improper municipal disposal practices and envisioned a limited Federal role.

Congress re-evaluated its position on the management of discarded materials and in 1970 passed the Resource Recovery Act which broadened the emphasis of the Solid Waste Disposal Act to include material self-sufficiency and conservation objectives and the special impacts of hazardous wastes. The Resource Recovery Act of 1970 included: (1) authorization for demonstration grants for new resource recovery technology; (2) requirement of study and investigation of various means of resource recovery and waste reduction and an annual report of the results; (3) authorization for setting up a National Commission on Materials Policy. (This Commission recommended a strong program in the area of resource recovery and conservation. More recently, Congress established a National Commission on Shortages and Scarcities to further this work. Thus, to a considerable degree, the discarded materials issue is now seen as part of the broader national material use issue); and (4) requirement for "a comprehensive report and plan for the creation of a system of national disposal sites for the storage and disposal of hazardous wastes, including radioactive, toxic chemical, biological, and other wastes which may endanger public health or welfare."

1. Table V-1, at page 76, is a reprint of the Solid Waste Disposal Act of 1965, as amended (P.L. 89-272).

TABLE V-I

SOLID WASTE DISPOSAL ACT

[PUBLIC LAW 89-272—89TH CONGRESS, S. 306, APPROVED OCTOBER 20, 1965]

AN ACT To authorize a research and development program with respect to solid-waste disposal, and for other purposes.

* * * * * * *

TITLE II—SOLID WASTE DISPOSAL [1]

SHORT TITLE

SEC. 201. This title (hereinafter referred to as "this Act") may be cited as the "Solid Waste Disposal Act".

FINDINGS AND PURPOSES

SEC. 202. (a) The Congress finds—

(1) that the continuing technological progress and improvement in methods of manufacture, packaging, and marketing of consumer products has resulted in an ever-mounting increase, and in a change in the characteristics, of the mass of material discarded by the purchaser of such products;

(2) that the economic and population growth of our Nation, and the improvements in the standard of living enjoyed by our population, have required increased industrial production to meet our needs, and have made necessary the demolition of old buildings, the construction of new buildings, and the provision of highways and other avenues of transportation, which, together with related industrial, commercial, and agricultural operations, have resulted in a rising tide of scrap, discarded, and waste materials;

(3) that the continuing concentration of our population in expanding metropolitan and other urban areas has presented these communities with serious financial, management, intergovernmental, and technical problems in the disposal of solid wastes resulting from the industrial, commercial, domestic, and other activities carried on in such areas;

(4) that inefficient and improper methods of disposal of solid wastes result in scenic blights, create serious hazards to the public health, including pollution of air and water resources, accident hazards, and increase in rodent and insect vectors of disease, have an adverse effect on land values create public nuisances, otherwise interfere with community life and development;

(5) that the failure or inability to salvage and reuse such materials economically results in the unnecessary waste and depletion of our natural resources; and

(6) that while the collection and disposal of solid wastes should continue to be primarily the function of State, regional, and local agencies, the problems of waste disposal as set forth above have become a matter national in scope and in concern and necessitate Federal action through financial and technical assistance and leadership in the development, demonstration, and application of new and improved methods and processes to reduce the amount of waste and unsalvageable materials and to provide for proper and economical solid-waste disposal practices.

(b) [2] The purposes of this Act therefore are—

(1) to promote the demonstration, construction, and application of solid waste management and resource recovery systems which preserve and enhance the quality of air, water, and land resources;

(2) to provide technical and financial assistance to States and local governments and interstate agencies in the planning and development of resource recovery and solid waste disposal programs;

(3) to promote a national research and development program for improved management techniques, more effective organizational arrangements, and new and improved methods of collection, separation, recovery, and recycling of solid wastes, and the environmentally safe disposal of nonrecoverable residues;

(4) to provide for the promulgation of guidelines for solid waste collection, transport, separation, recovery, and disposal systems; and

(5) to provide for training grants in occupations involving the design, operation, and maintenance of solid waste disposal systems.

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[1] Title I of P.L. 89-272 amended the Clean Air Act (P.L. 88-206).
[2] Sec. 202(b) amended by sec. 101, P.L. 91-512.

DEFINITIONS

SEC. 203.[3] When used in this Act:

(1) [3a] The term "Secretary" means the Secretary of Health, Education, and Welfare; except that such term means the Secretary of the Interior with respect to problems of solid waste resulting from the extraction, processing, or utilization of minerals or fossil fuels where the generation, production, or reuse of such waste is or may be controlled within the extraction, processing, or utilization facility or facilities and where such control is a feature of the technology or economy of the operation of such facility or facilities.

(2) The term "State" means a State, the District of Columbia, the Commonwealth of Puerto Rico, the Virgin Islands, Guam, and American Samoa.

(3) The term "interstate agency" means an agency of two or more municipalities in different States, or an agency established by two or more States, with authority to provide for the disposal of solid wastes and serving two or more municipalities located in different States.

(4) The term "solid waste" means garbage, refuse, and other discarded solid materials, including solid-waste materials resulting from industrial, commercial, and agricultural operations, and from community activities, but does not include solids or dissolved material in domestic sewage or other significant pollutants in water resources, such as silt, dissolved or suspended solids in industrial waste water effluents, dissolved materials in irrigation return flows or other common water pollutants.

(5) The term "solid-waste disposal" means the collection, storage, treatment, utilization, processing, or final disposal of solid waste.

(6) The term "construction," with respect to any project of construction under this act, means (A) the erection or building of new structures and acquisition of lands or interests therein, or the acquisition, replacement, expansion, remodeling, alteration, modernization, or extension of existing structures, and (B) the acquisition and installation of initial equipment of, or required in connection with, new or newly acquired structures or the expanded, remodeled, altered, modernized or extended part of existing structures (including trucks and other motor vehicles, and tractors, cranes, and other machinery) necessary for the proper utilization and operation of the facility after completion of the project; and includes preliminary planning to determine the economic and engineering feasibility and the public health and safety aspects of the project, the engineering, architectural, legal, fiscal, and economic investigations and studies, and any surveys, designs, plans, working drawings, specifications, and other action necessary for the carrying out of the project, and (C) the inspection and supervision of the process of carrying out the project to completion.

(7) The term "municipality" means a city, town, borough, county, parish, district, or other public body created by or pursuant to State law with responsibility for the planning or administration of solid waste disposal, or an Indian tribe.

(8) The term "intermunicipal agency" means an agency established by two or more municipalities with responsibility for planning or administration of solid waste disposal.

(9) The term "recovered resources" means materials or energy recovered from solid wastes.

(10) The term "resource recovery system" means a solid waste management system which provides for collection, separation, recycling, and recovery of solid wastes, including disposal of nonrecoverable waste residues.

RESEARCH, DEMONSTRATIONS, TRAINING, AND OTHER ACTIVITIES

SEC. 204.[4] (a) The Secretary shall conduct, and encourage, cooperate with, and render financial and other assistance to appropriate public (whether Federal, State, interstate, or local) authorities, agencies, and institutions, private agencies and

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[3] Sec. 203 amended by sec. 102, P.L. 91–512.

[3a] By reason of the establishment of the U.S. Environmental Protection Agency, in December 1970, the references in the cited legislation to "The Secretary" or to "The Secretary of Health, Education and Welfare" should be *changed* to read "The Administrator" or "The Administrator, Environmental Protection Agency." Authority for this change: The President's Reorganization Plan No. 3 of 1970. There are 30 or more places in the legislation where such changes should be made beginning with Section 203 (p. 2), entitled "Definitions."

/Specific references in the legislation to the Secretary of any other Department of the Executive Branch should *not* be changed.

[4] Sec. 204(a) amended by Sec. 103, P.L. 91–512.

institutions, and individuals in the conduct of, and promote the coordination of, research, investigations, experiments, training, demonstrations, surveys, and studies relating to—

(1) any adverse health and welfare effects of the release into the environment of material present in solid waste, and methods to eliminate such effects;

(2) the operation and financing of solid waste disposal programs;

(3) the reduction of the amount of such waste and unsalvageable waste materials;

(4) the development and application of new and improved methods of collecting and disposing of solid waste and processing and recovering materials and energy from solid wastes; and

(5) the identification of solid waste components and potential materials and energy recoverable from such waste components.

(b) In carrying out the provisions of the preceding subsection, the Secretary is authorized to—

(1) collect and make available, through publications and other appropriate means, the results of, and other information pertaining to, such research and other activities, including appropriate recommendations in connection therewith;

(2) cooperate with public and private agencies, institutions, and organizations, and with any industries involved, in the preparation and the conduct of such research and other activities; and

(3) make grants-in-aid to public or private agencies and institutions and to individuals for research, training projects, surveys, and demonstrations (including construction of facilities), and provide for the conduct of research, training, surveys, and demonstrations by contract with public or private agenices and institutions and with individuals; and such contracts for research or demonstrations or both (including contracts for construction) may be made in accordance with and subject to the limitations provided with respect to research contracts of the military departments in title 10, United States Code, section 2353, except that the determination, approval, and certification required thereby shall be made by the Secretary.

(c) Any grant, agreement, or contract made or entered into under this section shall contain provisions effective to insure that all information, uses, processes, patents and other developments resulting from any activity undertaken pursuant to such grant, agreement, or contract will be made readily available on fair and equitable terms to industries utilizing methods of solid-waste disposal and industries engaging in furnishing devices, facilities, equipment, and supplies to be used in connection with solid-waste disposal. In carrying out the provisions of this section, the Secretary and each department, agency, and officer of the Federal Government having functions or duties under this Act shall make use of and adhere to the Statement of Government Patent Policy which was promulgated by the President in his memorandum of October 10, 1063. (3 CFR, 1963 Supp., p. 238.)

SPECIAL STUDY AND DEMONSTRATION PROJECTS ON RECOVERY OF USEFUL ENERGY AND MATERIALS

SEC. 205.[5] (a) The Secretary shall carry out an investigation and study to determine—

(1) means of recovering materials and energy from solid waste, recommended uses of such materials and energy for national or international welfare, including identification of potential markets for such recovered resources, and the impact of distribution of such resources on existing markets;

(2) changes in current product characteristics and production and packaging practices which would reduce the amount of solid waste;

(3) methods of collection, separation, and containerization which will encourage efficient utilization of facilities and contribute to more effective programs of reduction, reuse, or disposal of wastes;

(4) the use of Federal procurement to develop market demand for recovered resources;

(5) recommended incentives (including Federal grants, loans, and other assistance) and disincentives to accelerate the reclamation or recycling of materials from solid wastes, with special emphasis on motor vehicle hulks;

(6) the effect of existing public policies, including subsidies and economic incentives and disincentives, percentage depletion allowances, capital gains treatment and other tax incentives and disincentives, upon the recycling and reuse of materials, and the likely effect of the modification or elimination

[5] Sec. 205 added by sec. 104(a) of P.L. 91–512.

of such incentives and disincentives upon the reuse, recycling and conservation of such materials; and

(7) the necessity and method of imposing disposal or other charges on packaging, containers, vehicles, and other manufactured goods, which charges would reflect the cost of final disposal, the value of recoverable components—of the item, and any social costs associated with nonrecycling or uncontrolled disposal of such items.

The Secretary shall from time to time, but not less frequently than annually, report the results of such investigation and study to the President and the Congress.

(b) The Secretary is also authorized to carry out demonstration projects to test and demonstrate methods and techniques developed pursuant to subsection (a).

(c) Section 204 (b) and (c) shall be applicable to investigations, studies, and projects carried out under this section.

INTERSTATE AND INTERLOCAL COOPERATION

SEC. 206.[6] The Secretary shall encourage cooperative activities by the States and local governments in connection with solid-waste disposal programs; encourage where practicable, interstate, interlocal, and regional planning for, and the conduct of, interstate, interlocal, and regional solid-waste disposal programs; and encourage the enactment of improved and, so far as practicable, uniform State and local laws governing solid-waste disposal.

GRANTS FOR STATE, INTERSTATE, AND LOCAL PLANNING

SEC. 207.[7] (a) The Secretary may from time to time, upon such terms and conditions consistent with this section as he finds appropriate to carry out the purposes of this Act, make grants to State, interstate, municipal, and intermunicipal agencies, and organizations composed of public officials which are eligible for assistance under section 701(g) of the Housing Act of 1954, of not to exceed 66⅔ per centum of the cost in the case of an application with respect to an area including only one municipality, and not to exceed 75 per centum of the cost in any other case, of—

(1) making surveys of solid waste disposal practices and problems within the jurisdictional areas of such agencies and

(2) developing and revising solid waste disposal plans as part of regional environmental protection systems for such areas, providing for recycling or recovery of materials from wastes whenever possible and including planning for the reuse of solid waste disposal areas and studies of the effect and relationship of solid waste disposal practices on areas adjacent to waste disposal sites,

(3) developing proposals for projects to be carried out pursuant to section 208 of this Act, or

(4) planning programs for the removal and processing of abandoned motor vehicle hulks.

(b) Grants pursuant to this section may be made upon application therefor which—

(1) designates or establishes a single agency (which may be an interdepartmental agency) as the sole agency for carrying out the purposes of this section for the area involved;

(2) indicates the manner in which provision will be made to assure full consideration of all aspects of planning essential to areawide planning for proper and effective solid waste disposal consistent with the protection of the public health and welfare, including such factors as population growth, urban and metropolitan development, land use planning, water pollution control, air pollution control, and the feasibility of regional disposal and resource recovery programs;

(3) sets forth plans for expenditure of such grant, which plans provide reasonable assurance of carrying out the purposes of this section;

(4) provides for submission of such reports of the activities of the agency in carrying out the purposes of this section, in such form and containing such information, as the Secretary may from time to time find necessary for carrying out the purposes of this section and for keeping such records and affording such access thereto as he may find necessary; and

[6] Previous sec. 205 redesignated as sec. 206 by sec. 104(a) of P.L. 91–512.
[7] Sec. 207 added by sec. 104(b) of P.L. 91–512.

(5) provides for such fiscal-control and fund-accounting procedures as may be necessary to assure proper disbursement of and accounting for funds paid to the agency under this section.

(c) The Secretary shall make a grant under this section only if he finds that there is satisfactory assurance that the planning of solid waste disposal will be coordinated, so far as practicable, with and not duplicate other related State, interstate, regional, and local planning activities, including those financed in part with funds pursuant to section 701 of the Housing Act of 1954.

GRANTS FOR RESOURCE RECOVERY SYSTEMS AND IMPROVED SOLID WASTE DISPOSAL FACILITIES

SEC. 208.[8] (a) The Secretary is authorized to make grants pursuant to this section to any State, municipal, or interstate or intermunicipal agency for the demonstration of resource recovery systems or for the construction of new or improved solid waste disposal facilities.

(b)(1) Any grant under this section for the demonstration of a resource recovery system may be made only if it (A) is consistent with any plans which meet the requirements of section 207(b)(2) of this Act; (B) is consistent with the guidelines recommended pursuant to section 209 of this Act; (C) is designed to provide areawide resource recovery systems consistent with the purposes of this Act, as determined by the Secretary, pursuant to regulations promulgated under under subsection (d) of this section; and (D) provides an equitable system for distributing the costs associated with construction, operation, and maintenance of any resource recovery system among the users of such system.

(2) The Federal share for any project to which paragraph (1) applies shall not be more than 75 percent.

(c)(1) A grant under this section for the construction of a new or improved solid waste disposal facility may be made only if—

(A) a State or interstate plan for solid waste disposal has been adopted which applies to the area involved, and the facility to be constructed (i) is consistent with such plan, (ii) is included in a comprehensive plan for the area involved which is satisfactory to the Secretary for the purposes of this Act, and (iii) is consistent with the guidelines recommended under section 209, and

(B) the project advances the state of the art by applying new and improved techniques in reducing the environmental impact of solid waste disposal, in achieving recovery of energy or resources, or in recycling useful materials.

(2) The Federal share for any project to which paragraph (1) applies shall be not more than 50 percent in the case of a project serving an area which includes only one municipality, and not more than 75 percent in any other case.

(d)(1) The Secretary, within ninety days after the date of enactment of the Resource Recovery Act of 1970, shall promulgate regulations establishing a procedure for awarding grants under this section which—

(A) provides that projects will be carried out in communities of varying sizes, under such conditions as will assist in solving the community waste problems of urban-industrial centers, metropolitan regions, and rural areas, under representative geographic and environmental conditions; and

(B) provides deadlines for submission of, and action on, grant requests.

(2) In taking action on applications for grants under this section, consideration shall be given by the Secretary (A) to the public benefits to be derived by the construction and the propriety of Federal aid in making such grant; (B) to the extent applicable, to the economic and commercial viability of the project (including contractual arrangements with the private sector to market any resources recovered); (C) to the potential of such project for general application to community solid waste disposal problems; and (D) to the use by the applicant of comprehensive regional or metropolitan area planning.

(e) A grant under this section—

(1) may be made only in the amount of the Federal share of (A) the estimated total design and construction costs, plus (B) in the case of a grant to which subsection (b)(1) applies, the first-year operation and maintenance costs;

(2) may not be provided for land acquisition or (except as otherwise provided in paragraph (1)(B)) for operating or maintenance costs;

[8] Sec. 208 added by sec. 104(b) P.L. 91–512.

(3) may not be made until the applicant has made provision satisfactory to the Secretary for proper and efficient operation and maintenance of the project (subject to paragraph (1)(B)); and

(4) may be made subject to such conditions and requirements, in addition to those provided in this section, as the Secretary may require to properly carry out his functions pursuant to this Act.

For purposes of paragraph (1), the non-Federal share may be in any form, including, but not limited to, lands or interests therein needed for the project or personal property or services, the value of which shall be determined by the Secretary.

(f)(1) Not more than 15 percent of the total of funds authorized to be appropriated under section 216(a)(3) for any fiscal year to carry out this section shall be granted under this section for projects in any one State.

(2) The Secretary shall prescribe by regulation the manner in which this subsection shall apply to a grant under this section for a project in an area which includes all or part of more than one State.

RECOMMENDED GUIDELINES

SEC. 209.[9] (a) The Secretary shall, in cooperation with appropriate State, Federal, interstate, regional, and local agencies, allowing for public comment by other interested parties, as soon as practicable after the enactment of the Resource Recovery Act of 1970, recommend to appropriate agencies and publish in the Federal Register guidelines for solid waste recovery, collection, separation, and disposal systems (including systems for private use), which shall be consistent with public health and welfare, and air and water quality standards and adaptable to appropriate land-use plans. Such guidelines shall apply to such systems whether on land or water and shall be revised from time to time.

(b)(1) The Secretary shall, as soon as practicable, recommend model codes, ordinances, and statutes which are designed to implement this section and the purposes of this Act.

(2) The Secretary shall issue to appropriate Federal, interstate, regional, and local agencies information on technically feasible solid waste collection, separation, disposal, recycling, and recovery methods, including data on the cost of construction, operation, and maintenance of such methods.

GRANTS OR CONTRACTS FOR TRAINING PROJECTS

SEC. 210.[10] (a) The Secretary is authorized to make grants to, and contracts with, any eligible organization. For purposes of this section the term "eligible organization" means a State or interstate agency, a municipality, educational institution, and any other organization which is capable of effectively carrying out a project which may be funded by grant under subsection (b) of this section.

(b)(1) Subject to the provisions of paragraph (2), grants or contracts may be made to pay all or a part of the costs, as may be determined by the Secretary, of any project operated or to be operated by an eligible organization, which is designed—

(A) to develop, expand, or carry out a program (which may combine training, education, and employment) for training persons for occupations involving the management, supervision, design, operation, or maintenance of solid waste disposal and resources recovery equipment and facilities; or

(B) to train instructors and supervisory personnel to train or supervise persons in occupations involving the design, operation, and maintenance of solid waste disposal and resource recovery equipment and facilities.

(2) A grant or contract authorized by paragraph (1) of this subsection may be made only upon application to the Secretary at such time or times and containing such information as he may prescribe, except that no such application shall be approved unless it provides for the same procedures and reports (and access to such reports and to other records) as is required by section 207(b) (4) and (5) with respect to applications made under such section.

(c) The Secretary shall make a complete investigation and study to determine—

(1) the need for additional trained State and local personnel to carry out plans assisted under this Act and other solid waste and resource recovery programs;

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[9] Sec. 209 added by sec. 104(b) P.L. 91–512.
[10] Sec. 210 added by sec. 104(b) P.L. 91–512.

(2) means of using existing training programs to train such personnel; and

(3) the extent and nature of obstacles to employment and occupational advancement in the solid waste disposal and resource recovery field which may limit either available manpower or the advancement of personnel in such field.

He shall report the results of such investigation and study, including his recommendations to the President and the Congress not later than one year after enactment of this Act.

APPLICABILITY OF SOLID WASTE DISPOSAL GUIDELINES TO EXECUTIVE AGENCIES

SEC. 211.[11] (a)(1) If—

(A) an Executive agency (as defined in section 105 of title 5, United States Code) has jurisdiction over any real property or facility the operation or administration of which involves such agency in solid waste disposal activities, or

(B) such an agency enters into a contract with any person for the operation by such person of any Federal property or facility, and the performance of such contract involves such person in solid waste disposal activities,

then such agency shall insure compliance with the guidelines recommended under section 209 and the purposes of this Act in the operation of administration of such property or facility, or the performance of such contract, as the case may be.

(2) Each Executive agency which conducts any activity—

(A) which generates solid waste, and

(B) which, if conducted by a person other than such agency, would require a permit or license from such agency in order to dispose of such solid waste,

shall insure compliance with such guidelines and the purposes of this Act in conducting such activity.

(3) Each Executive agency which permits the use of Federal property for purposes of disposal of solid waste shall incure compliance with such guidelines and the purposes of this Act in the disposal of such waste.

(4) The President shall prescribe regulations to carry out this subsection.

(b) Each Executive agency which issues any license or permit for disposal of solid waste shall, prior to the issuance of such license or permit, consult with the Secretary to insure compliance with guidelines recommended under section 209 and the purposes of this Act.

NATIONAL DISPOSAL SITES STUDY

SEC. 212.[12] The Secretary shall submit to the Congress no later than two years after the date of enactment of the Resource Recovery Act of 1970, a comprehensive report and plan for the creation of a system of national disposal sites for the storage and disposal of hazardous wastes, including radioactive, toxic chemical, biological, and other wastes which may endanger public health or welfare. Such report include: (1) a list of materials which should be subject to disposal in any such site; (2) current methods of disposal of such materials; (3) recommended methods of reduction, neutralization, recovery, or disposal of such materials; (4) an inventory of possible sites including existing land or water disposal sites operated or licensed by Federal agencies; (5) an estimate of the cost of developing and maintaining sites including consideration of means for distributing the short- and long-term costs of operating such sites among the users thereof; and (6) such other information as may be appropriate.

LABOR STANDARDS

SEC. 213.[13] No grant for a project of construction under this Act shall be made unless the Secretary finds that the application contains or is supported by reasonable assurance that all laborers and mechanics employed by contractors or subcontractors on projects of the type covered by the Davis-Bacon Act, as amended (40 U.S.C. 276a—276a-5), will be paid wages at rates not less than those prevailing on similar work in the locality as determined by the Secretary of Labor in accordance with that Act; and the Secretary of Labor shall have with respect to the labor standards specified in this section the authority and functions set forth in Reorganization Plan Numbered 14 of 1950 (15 F.R. 3176; 5 U.S.C. 133z-15) and section 2 of the Act of June 13, 1934, as amended (40 U.S.C. 276c).

[11] Sec. 211 added by sec. 104(b) P.L. 91-512.
[12] Sec. 212 added by sec. 104(b) of P.L. 91-512.
[13] Former secs. 207 through 210 redesignated as secs. 213 through 216 by sec. 104(b) of P.L. 91-512.

OTHER AUTHORITY NOT AFFECTED

SEC. 214. This Act shall not be construed as superseding or limiting the authorities and responsibilities, under any other provisions of law, of the Secretary of Health, Education, and Welfare, the Secretary of the Interior, or any other Federal Officer, department, or agency.

GENERAL PROVISIONS

SEC. 215.[14] (a) Payments of grants under this Act may be made (after necessary adjustment on account of previously made underpayments or overpayments) in advance or by way of reimbursement, and in such installments and on such conditions as the Secretary may determine.

(b) No grant may be made under this Act to any private profitmaking organization.

SEC. 216.[15] (a)(1) There are authorized to be appropriated to the Secretary of Health, Education, and Welfare for carrying out the provisions of this Act (including, but not limited to, section 208), not to exceed $41,500,000 for the fiscal year ending June 30, 1971.

(2) There are authorized to be appropriated to the Administrator of the Environmental Protection Agency to carry out the provisions of this Act, other than section 208, not to exceed $72,000,000 for the fiscal year ending June 30, 1972, and not to exceed $76,000,000 for the fiscal year ending June 30, 1973, not to exceed $76,000,000 for the fiscal year ending June 30, 1974, and not to exceed $76,000,000 for the fiscal year ending June 30, 1975.[16]

(3) There are authorized to be appropriated to the Administrator of the Environmental Protection Agency to carry out section 208 of this Act not to exceed $80,000,000 for the fiscal year ending June 30, 1972, and not to exceed $140,000,000 for the fiscal year ending June 30, 1973, and not to exceed $140,000,000 for the fiscal year ending June 30, 1974.[17]

(b) There are authorized to be appropriated to the Secretary of the Interior to carry out this Act not to exceed $8,750,000 for the fiscal year ending June 30, 1971, not to exceed $20,000,000 for the fiscal year ending June 30, 1972, not to exceed $22,500,000 for the fiscal year ending June 30, 1973, and not to exceed $22,500,000 for the fiscal year ending June 30, 1974.[17] Prior to expending any funds authorized to be appropriated by this subsection, the Secretary of the Interior shall consult with the Secretary of Health, Education, and Welfare to assure that the expenditure of such funds will be consistent with the purposes of this Act.

(c) Such portion as the Secretary may determine, but not more than 1 per centum, of any appropriation for grants, contracts, or other payments under any provision of this Act for any fiscal year beginning after June 30, 1970, shall be available for evaluation (directly, or by grants or contracts) of any program authorized by this Act.

(d) Sums appropriated under this section shall remain available until expended.

1. The Solid Waste Disposal Act of 1965 was amended:

a. By the Resource Recovery Act of 1970, P.L. 91–512, 91st Congress, H.R. 11833, October 26, 1970;

b. By P.L. 93–14, 93rd Congress, H.R. 5446, April 9, 1973 (to extend the amended Solid Waste Disposal Act for one year); and

c. By P.L. 93–611, 93rd Congress, H.R. 16045, January 2, 1975 (to amend the Solid Waste Disposal Act to authorize appropriations for fiscal year 1975).

B. TABULATION OF FEDERAL EXPENDITURES FOR DISCARDED MATERIALS PROGRAMS

The following tabulation shows the total Federal spending under the Solid Waste Disposal Act since the last major legislative amendment in 1971 (Source: Environmental Protection Agency, 1975).

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[14] Sec. 215 as redesignated by sec. 104(b) of P.L. 91–512 further amended by sec. 104(c) of that Act.

[15] Sec. 216 as redesignated by sec. 104(b) of P.L. 91–512 further amended by sec. 105 of that Act.

[16] P.L. 93–14 extended authorization of funding to June 30, 1974; P.L. 93–611 extended authorization to June 30, 1975.

[17] P.L. 93–14 extended authorization of funding to June 30, 1974.

TOTAL FUNDING

[In thousands of dollars]

Fiscal year	Budget request	Appropriations	Obligations
1971	$17,986	$20,591	$17,982
1972	28,378	35,378	14,091
1973	21,433	36,553	43,732
1974	5,760	[1] 8,760	13,023
1975	14,689	19,529	[2] 16,300
1976	15,620	15,620	[3] 21,510
Total	103,866	121,311	111,968

[1] $15,000,000 additional was displayed in EPA's budget, but this was transferred to agricultural conservation program, Department of Agriculture, for animal waste facilities and solid waste disposal.
[2] Estimate.
[3] Estimate based on appropriation of $15,620 in the budget request.

SPENDING FOR RESOURCE RECOVERY DEMONSTRATIONS

One section of the Solid Waste Disposal Act, as amended, has distinct authorizations and appropriations, while all other sections are lumped together. The table below displays the portion of total spending (above) that addresses Section 208 of the Act: Grants for Resource Recovery Systems.

SECTION 208

[In thousands of dollars]

Fiscal year	Budget request	Appropriations	Obligations
1971	0	0	0
1972	$4,093	$11,593	$560
1973	0	15,000	20,349
1974	0	0	633
1975	0	0	[1] 2,567
1976	0	0	0
Total	4,093	26,593	24,109

[1] Estimate.

ALLOCATION OF RESOURCES WITHIN EPA

The table below indicates EPA's use of funds over the past two years. These are allocations of funds at the appropriations level.

[In thousands of dollars]

	1975 allocation	1976 allocation
Research and development (ORD)	$5,700	$4,000
Regional staff (10 regions)	900	1,000
Hazardous wastes	3,400	2,800
Land disposal and waste management	2,100	2,300
Resource conservation	3,200	2,200
State programs	2,800	2,800
Program management and support	1,400	1,500
Total	19,500	15,600

GLOSSARY

Air pollution by way of sublimation—air pollution generated by the direct conversion of a solid material into a gaseous pollutant.

Aquifer—a geologic formation, group of formations, or part of a formation that is capable of yielding a significant amount of water to a well or spring, a water-bearing stratum of permeable rock, sand or gravel.

Balance of payments—summary of the international transactions of a country over a period of time, including commodity and service transactions, capital transactions, and gold movements.

British thermal unit (Btu)—quantity of heat required to raise the temperature of one pound of water one degree Fahrenheit at or near 39.2° F.

Cost depletion allowance—provides for the recovery of the investment required to exploit a mineral deposit. A percentage of the costs acquiring a deposit can be deducted equal to the percentage of mineral deposit extracted for that year.

Cullet—broken or refuse glass, usually added to new material to facilitate melting in making glass.

Discarded materials—any garbage, refuse, waste treatment plant sludge, and other discarded material, including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations, and from community activities, but does not include solid or dissolved materials in domestic sewage or dissolved materials in irrigation return flows or industrial discharges which are point sources subject to the Federal Water Pollution Control Act, or source, special nuclear, or by product material as defined by the Atomic Energy Act of 1954.

"Dry" ton—weight measurement after moisture content of discarded material has been removed.

Energy recovery—the recovery of energy values, either directly by burning combustible discarded materials in a boiler to produce steam or hot water, or indirectly by first processing the organic fraction of the discarded materials to produce a solid, liquid or gaseous fuel.

Ferrous—of or relating to, or containing iron, e.g. iron, steel and related alloys.

Fossil fuel—a material used to produce heat or power by burning, ultimately derived from living things, e.g. coal, oil and natural gas.

Gross National Product—the total value of the goods and services produced in a nation during a specified period (as a year).

Ground water—water within the earth that supplies wells and springs.

Leachate—the liquid that has percolated through the soil, solid waste, or other medium, from which it removes soluble components.

Materials conversion—the utilization for an economically valued purpose other than that for which the material was originally used, e.g. recovered glass or cullet as a building or road construction aggregate.

Materials recovery—the recovery of specific reprocessed secondary materials from discarded materials, which includes both direct recycling and materials conversion.

Methane production—methane and carbon dioxide are produced when discarded materials decompose in an anaerobic (oxygen-free) environment.

Open dump—area where refuse or other discarded materials are disposed of, in an open-air fashion, uncovered and unenclosed.

Ordnance—military supplies including weapons, ammunition, combat vehicles and maintenance equipment.

ppm—index of concentration of a pollutant or additive expressed in parts per million, generally on a weight basis.

Organic—of or related to or derived from living organisms.

Percentage depletion allowance—taking a fixed percentage of the gross income generated by the property in question.

Post-consumer discarded materials—those materials discarded by the final consumer, not by raw material producers and manufacturers. These include both bulky and non-bulky wastes typically collected in household refuse, as

well as similar materials from commercial and governmental office buildings, wholesale and retail trade establishments, and other general business and service sectors of the economy.

Pyrolysis—thermal decomposition of materials in the absence or near-absence of oxygen. This process results in: (1) a gas consisting primarily of hydrogen, methane, and carbon monoxide; (2) a liquid fuel that includes organic chemicals; and (3) a char consisting of almost pure carbon, plus any metal, glass or rock that may have been processed.

Recycling—i.e., direct recycling, the recovery of a material for an economically valued purpose similar to that for which the material was originally used, e.g. new paper products from wastepaper.

Resource recovery—a general term encompassing a wide variety of technical approaches for retrieving or creating economic values from discarded materials. This includes materials recovery, energy recovery and materials conversion.

Runoff—the portion of the precipitation on the land that ultimately reaches streams, especially the water from rain or melted snow that flows over the surface.

Sanitary landfill—engineered method of disposing of discarded materials in a manner that minimizes environmental hazards and nuisances. After a site is carefully selected, designed and prepared, the discarded materials are spread in thin layers, compacted to the smallest practical volume, and, at least at the end of each operating day, covered with compacted earth.

Sludge—a muddy or slushy mass, deposit or sediment as precipitated solid matter produced by water and sewage treatment processes.

Source reduction (or "waste reduction")—the prevention of discarded materials at their source, either by redesigning products or by otherwise changing societal patterns of consumption and generation of discarded materials.

Source separation—segregation of discarded materials at the point of discard for concentrated collection.

Standard Metropolitan Statistical Area (SMSA)—a reporting unit defined by the Bureau of Census, used to aggregate and report domestic socio-economic data.

Surface waters—that portion of water that appears on the land surface, including oceans, lakes, and rivers.

Toxic chemical—a poisonous substance obtained by a chemical process.

Virgin material—means a raw material, including previously unused copper, aluminum, lead, zinc, iron, or other metal or metal ore, any undeveloped resource that is, or with new technology will become, a source of raw materials.

Waste-water effluent—a waste liquid discharge from a manufacturing or treatment process, in its natural state, or partially or completely treated, that discharges into the environment.

Waterwall incinerator—furnace walls consisting of vertically arranged metal tubes joined side-to-side with metal braces. Radiant energy from the burning of discarded materials is absorbed by water passing through the tubes. Additional boiler packages, located in the flue, control the conversion of this water to steam of a specified temperature and pressure.

"Wet" ton—or "as generated" ton, assumes typical moisture content of the material prior to discard or collection.

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